DECEMBER 1945 — FIFTY-SECOND YEAR

MACHINERY

LEHIGH UNIVERSITY
DEC 18 1945
LIBRARY

An outstanding new model for high speed production of second operation work.

FOR BETTER GAGING . . . "GO" GREENFIELD

ARE YOU USING

Chromium Plated

THREAD GAGES for EXTRA WEAR?

The longer life of chromium plated gages more than makes up for their high first cost and results in worthwhile net savings.

While "Greenfield" has supplied chromium plated gages for many years, wartime expansion of facilities and research has enabled us to greatly improve our methods and quality. Now we can furnish a vastly superior product including Thread Gages as well as plain gages.

For further information on "Greenfield" chromium plated gages, call your "Greenfield Man" through your local "Greenfield" distributor.

GTD

GREENFIELD

GREENFIELD TAP and DIE CORPORATION

GREENFIELD, MASSACHUSETTS

DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

MACHINERY

DECEMBER, 1945

The superiority of high-quality all-welded tanks over riveted designs has been recognized by the Interstate Commerce Commission and by many concerns who require these tanks for the transportation of liquids and gases. The leading article in January MACHINERY will describe the technique employed in fabricating tanks of this type by the use of automatic welding machines only. Every inch of weld is X-rayed, and these X-rays show practically flawless tanks. Among other interesting articles to appear in the January issue will be "Electronic Equipment Facilitates Wire Rope Manufacture"; "New Applications of Crush Dressing"; and "Forging With Closed Dies in Hydraulic Presses."

Volume 52
Number 4

PRINCIPAL CONTENTS OF THIS NUMBER

For Complete Classified Contents, See Page 252

Copper Furnace Brazing - - - - - *By Glen A. Robinson* 139
Hydraulic Strippers Facilitate Drawing of Thin Shells *By Henry F. Hild* 147
New Officers of the National Machine Tool Builders' Association 154
Belt Grinding—One of the Later Developments in the Grinding Field - - - - - - - - - *By W. A. Papworth* 155
Recent Applications of the Thread-Rolling Process - - - - 161
Use of Solvents in Cleaning Machinery for Reconversion *By Mable Foy* 165
Aircraft Manufacturing Technique Applied to Bus Building *By R. B. Stubbs* 168
Putting Surplus Machine Tools to Work - - - - - - - - 176
Brazing Tool Tips to Shanks by Induction Heating *By T. A. Vernor and E. F. Adams* 178
How Germany Built Up Its Manufacturing Industries - - - 180
Method of Checking Compound Angles - - *By James Ahearn* 182
Editorial Comment - - - - - - - - - - - - - - 188
Production is the Main Foundation of Maximum Employment - 189

DEPARTMENTS

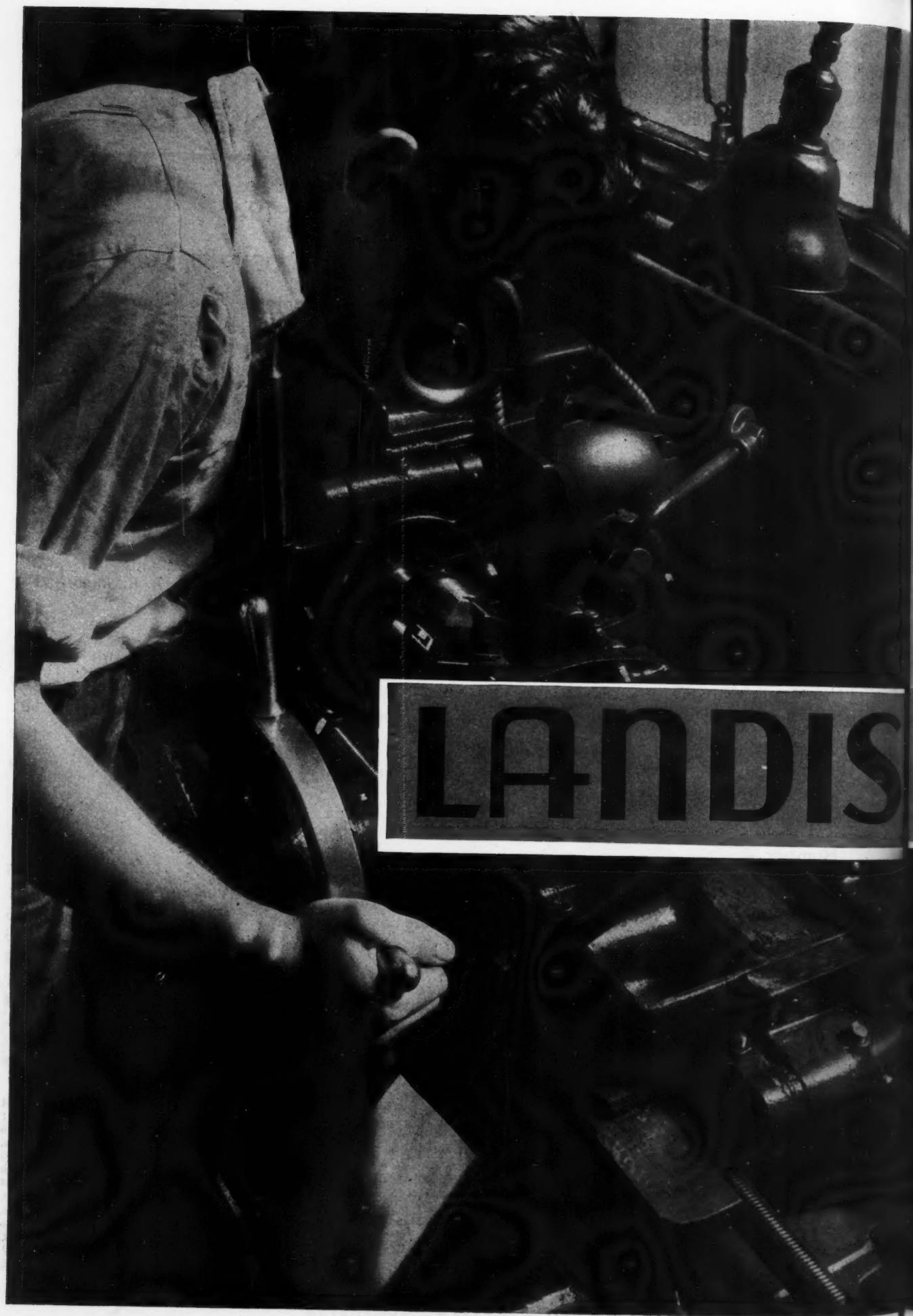
Engineering News - - - - - - - - - - - - - - 186
Design of Tools and Fixtures - - - - - - - - - - - 191
Questions and Answers - - - - - - - - - - - - - 195
Materials of Industry - - - - - - - - - - - - - - 196
Shop Equipment News - - - - - - - - - - - - - 199
New Trade Literature - - - - - - - - - - - - - 231
News of the Industry - - - - - - - - - - - - - 239

Product Index 444-463
Advertisers Index 465-466

TOTAL DISTRIBUTION
20,625

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street, New York 13, N. Y.
ROBERT B. LUCHARS.....*President*
EDGAR A. BECKER....*Vice-pres. and Treasurer*
ERIK OBERG.....
FRANKLIN D. JONES..... *Editors*
CHARLES O. HERB.....*Managing Editor*
FREEMAN C. DUSTON.....*Associate Editor*
HOLBROOK L. HORTON.....*Associate Editor*
WALTER E. ROBINSON, *Advertising Manager*
BRIGHTON, ENGLAND
MACHINERY, 17 Marine Parade

SUBSCRIPTION RATES: United States and Canada, one year, $4; two years, $7; three years, $8 (for Canada add 25 cents per year for war tax); foreign countries, $7 a year. Single copies, 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address.
Copyright 1945 by The Industrial Press.
Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America.
Member of A.B.P. Member of A.B.C.


LANDIS

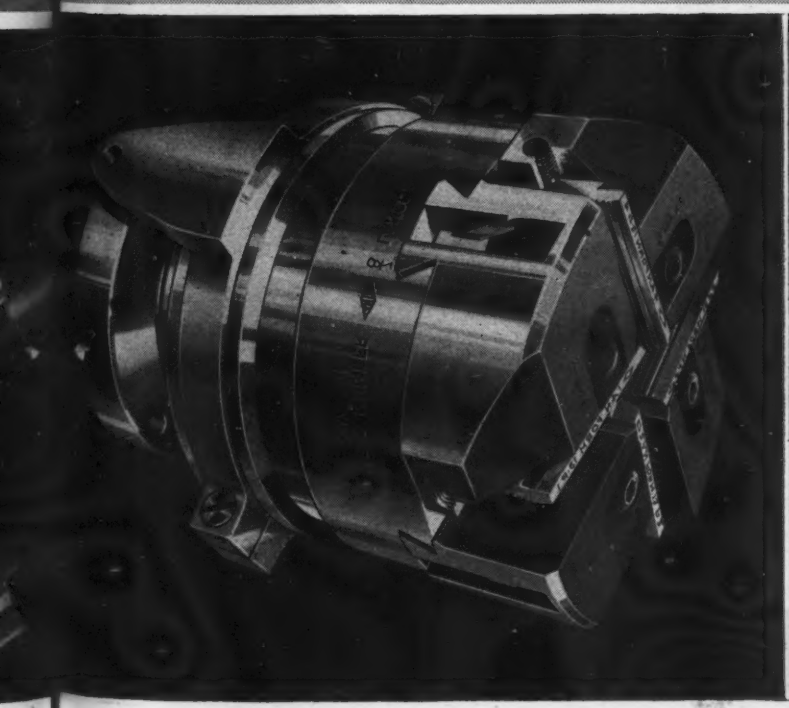
Proven in War for Peace

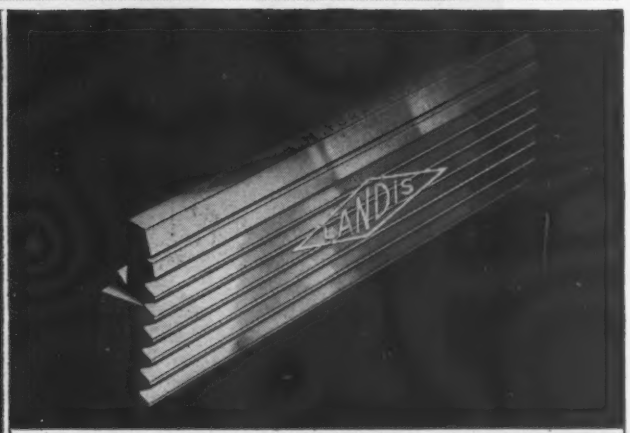
LANDIS THREADING MACHINES DIE HEADS AND CHASERS

Continuous operations, 24 hours a day, day in and day out, in hundreds of war plants have proven Landis Threading Machines, Die Heads and Chasers to be time savers and cost savers. In your post-war planning, Landis Threading Equipment, because of ease of operation, finer accuracy and greater production at lower maintenance cost, will be an important factor in meeting your post-war competition.

Write for Bulletin No. B-54

MACHINE CO. WAYNESBORO PENNA. U.S.A.





The illustration on the left-hand page shows a 7/8" single head Landis Threading Machine equipped with a 7V Lanco Hardened and Ground Head producing parts required in the manufacture of Fire Control Instruments.

NON-GEAR PART...

THE FELLOWS METHOD...MACHINES AND TOOLS FOR

...fast

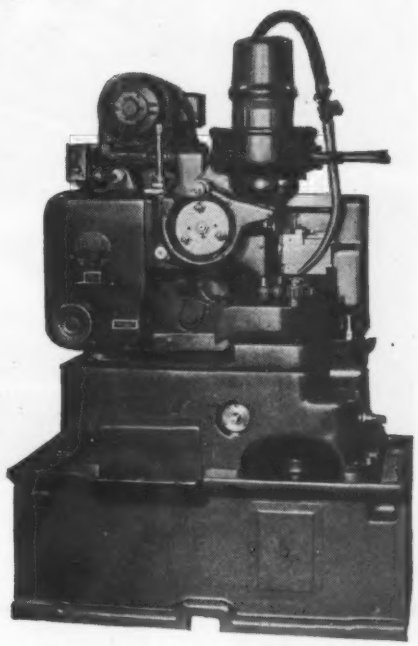
by the Same Machine that cuts Regular Gears

Many manufacturers, aware of the production advantages and economies afforded by the Fellows Gear Shaper in the cutting of all types of regular gears, also make full use of this many-purpose machine in the high-accuracy production of intricate non-gear parts.

The reason is that Fellows Cutters and Fixtures can be made to accomplish in a single set-up what would usually call for a series of operations—or the development of a costly "one-job-only" machine tool.

What's more, as soon as the Fellows Gear Shaper finishes the final run on one part, it only requires a short time to change the cutter, work outfits, or fixtures for the next assignment.

Ask the Fellows sales engineer to provide you with further details relative to your specific requirements—or write direct for your complimentary copy of "The Art of Generating with a Reciprocating Tool". The Fellows Gear Shaper Company, Springfield, Vermont, or 616 Fisher Bldg., Detroit 2, Mich., or 640 West Town Office Bldg., Chicago 12, Ill.



The versatile, 7-type Fellows high-speed Gear Shaper.

Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR

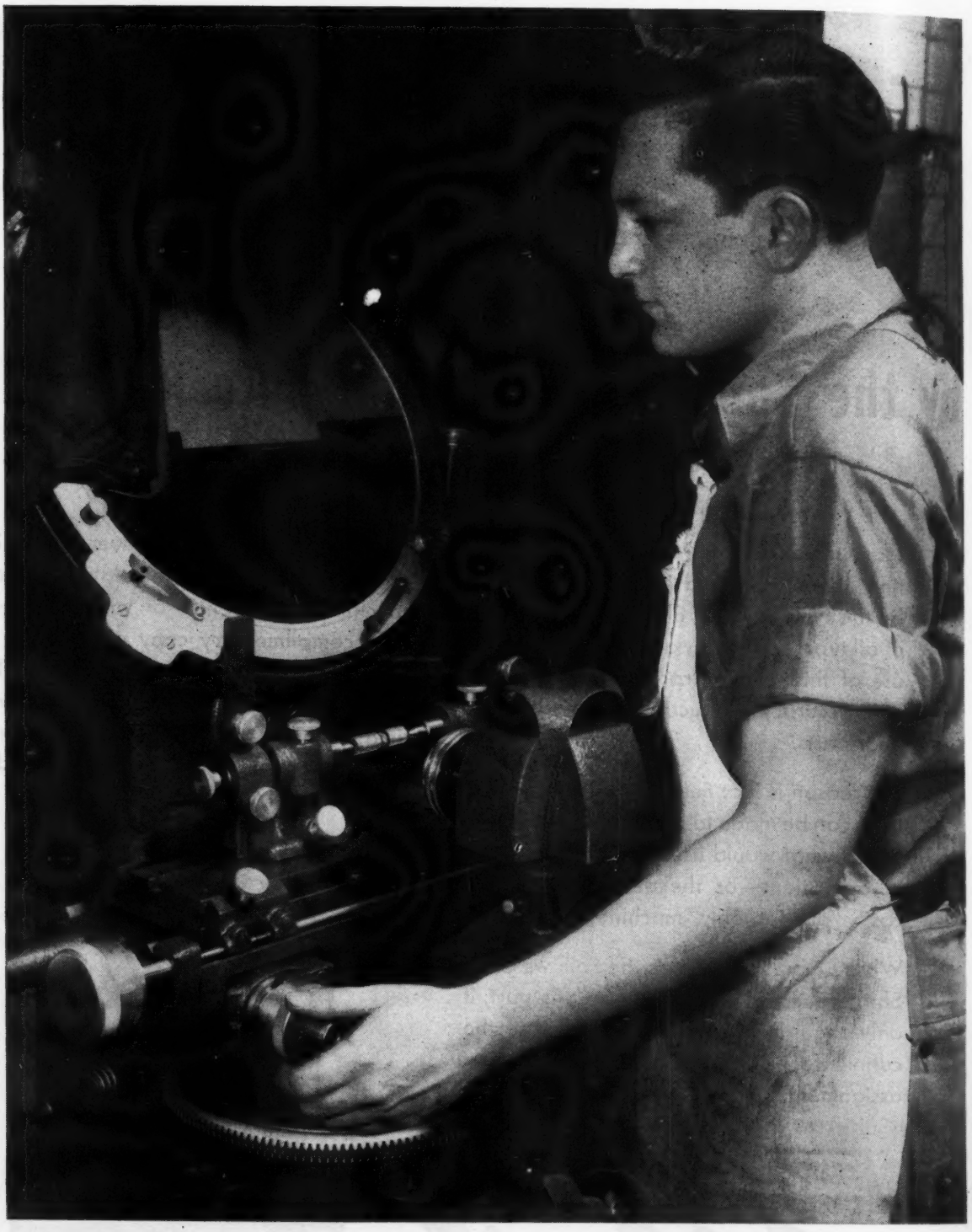


Photo courtesy of United Precision Products Company, Chicago, Illinois

This book "Beyond a Shadow of a Doubt" will tell you more about our Optical Comparators and what they are doing.

DID YOU KNOW...
THAT JONES & LAMSON OPTICAL COMPARATORS ARE USED TO INSPECT KNITTING NEEDLES AND SINKERS USED FOR KNITTING RAYON FABRICS

15 minutes...

AS COMPARED WITH ½ a day!

Precision gages and pins are checked for "utmost accuracy" on a Jones & Lamson Pedestal Optical Comparator and Measuring Machine in less than one tenth of the time it formerly took to inspect them without a Comparator. They are inspected for Length, Depth, Outline, Angles, Straightness and Grooves. This Optical Comparator is also used for inspecting Form Tools, Threads and other Profiles.

JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

OPTICAL COMPARATORS

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

BENCH COMPARATOR WITH 14" DIAM. SCREEN & MEASURING ATTACHMENTS
STANDARD BENCH COMPARATOR
BENCH COMPARATOR 14" DIAM. SCREEN
DIRECT PROJECTION COMPARATOR
STANDARD PEDESTAL COMPARATOR
PEDESTAL COMPARATOR 30" DIAM. SCREEN

CINCINNATI

COMPLETE

THE CINCINNATI M

MILLING MACHINES

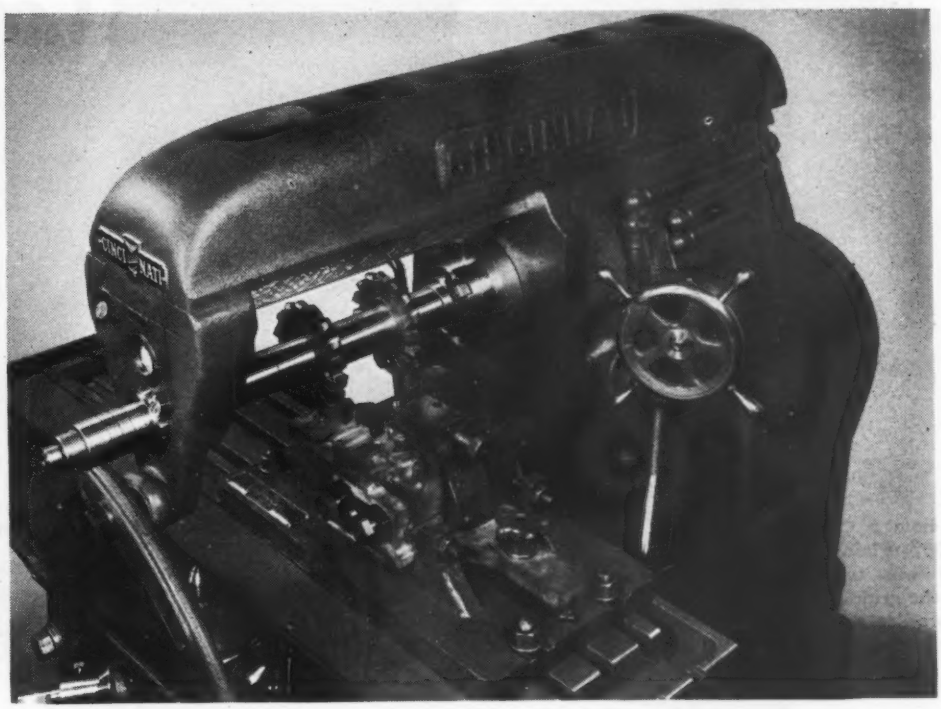
TAILOR-MADE MACHINE *or a* SIMPLE FIXTURE

IT'S ALL A PART OF

CINCINNATI ENGINEERING SERVICE

Illustrations on these two pages show examples of Cincinnati Engineering Service. It encompasses complete equipment from a simple fixture and cutters on a standard machine to completely special machines and tooling tailored to your requirements. ¶ Cincinnati Application Engineers will be glad to discuss the adaptation of standard machines to meet your needs, or the building of special equipment from the ground up. Whatever your milling requirements, it will be to your advantage to talk it over with our engineers.

Name of part: Supercharger Front Housing
Material: Magnesium
Operation: Rough Mill 29 Pads
Speed: 1200 feet per minute
Feed: 40" per minute
Depth of Cut: 1/8" to 1/2"
Production: 7 parts per hour
Machine: CINCINNATI Special Ram Type Five Spindle Miller



Name of part: Frame
Material: Cast Iron
Operation: Mill Notches in Lugs
Speed: 103 feet per minute
Feed: 7" per minute
Depth of Cut: From Solid
Production: 36 parts per hour
Machine: CINCINNATI No. 1-18 Plain Automatic Miller

MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

THIS EQUIPMENT...

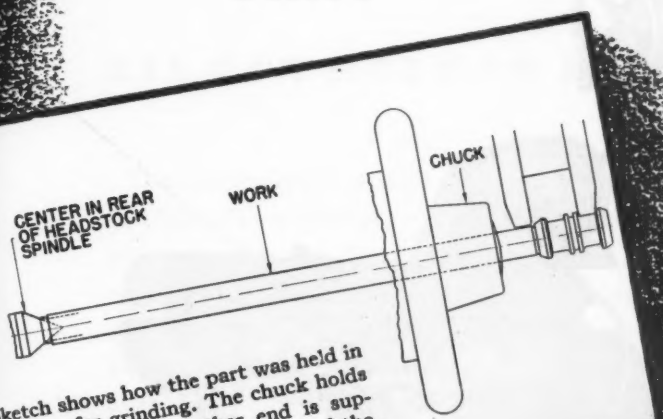
Here's how a **CINCINNATI** 6" x 30" Plain Hydraulic Grinder was tooled up to handle the grinding of diameters, profiles and shoulders on rod assembly.

CINCINNATI

CENTER TYPE GRINDING MACHINES

FACILITATES PROFILE GRINDING OPERATION ON END OF LONG, SLENDER PART

Grinding the diameters, profiles and shoulders on the end of this long, slender rod assembly was a problem in itself, but still another consideration was the elimination of conventional faceplate drive to speed handling. Here's how Cincinnati Application Engineers worked it out. ¶ A CINCINNATI 6″ x 30″ Plain Hydraulic Grinder was equipped with a special live spindle headstock; pull-in chuck with adapter; hydraulic truing device with bar type cam (for an infinite number of bearing surfaces before the cam wears out), and a special gap table arranged to clear the handwheel on chuck. The work extends part way through the headstock, supported at the rear end by a center in the rear of the spindle, and at the front end by the chuck. The setup illustrated handled the job more economically than other methods, with loading and unloading quick and easy. ¶ Cincinnati Application Engineers will be glad to discuss your grinding problems with you, and endeavor to work out more profitable methods for handling your centertype and centerless operations. Write for more details.



Sketch shows how the part was held in position for grinding. The chuck holds one end while the other end is supported by a center in the rear of the headstock spindle.

CINCINNATI

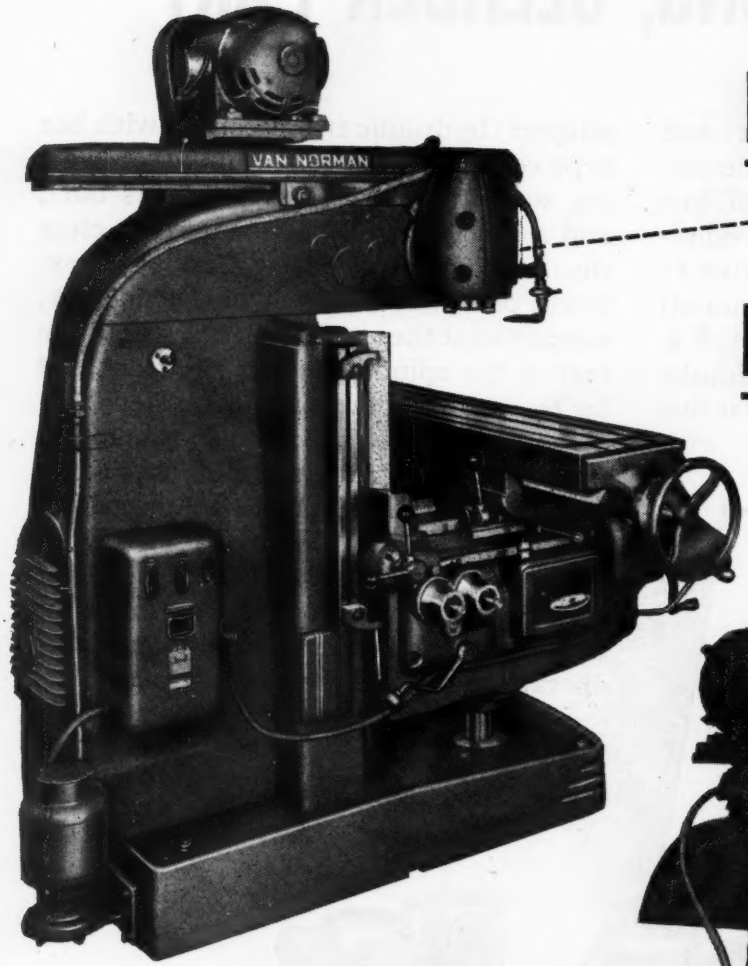
CINCINNATI 6″ Plain Hydraulic Grinding Machine. Catalog G-492-2 contains complete specifications. The Plain Hydraulics are available in 4″, 6″, 10″, 10″L, and 14″L sizes. Sweet's Catalog File gives a brief description.

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

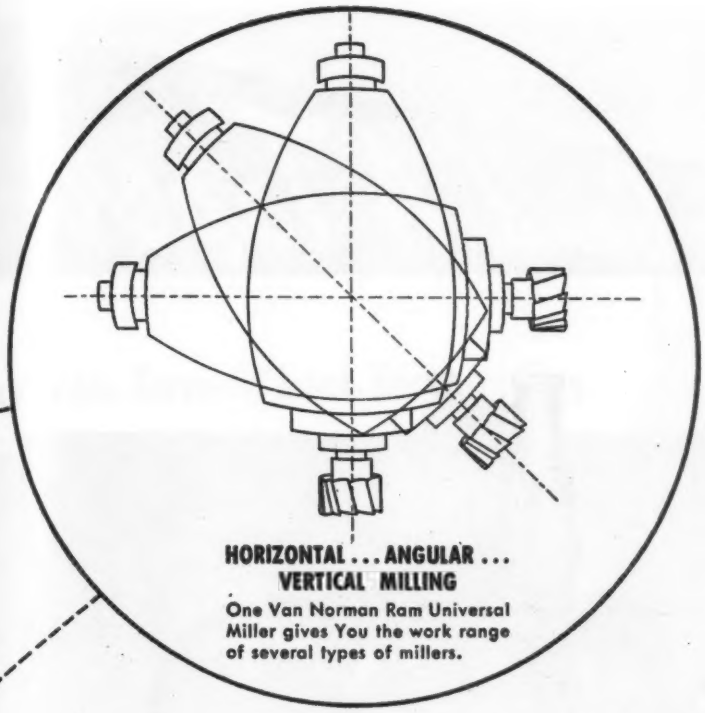
CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

For High Production Output...and Low Idle Machine Time



No. 36 Ram-Type Miller
Table: 58" x 13"
Ram movement 19"

No. 26 Ram-Type Miller
Table: 50" x 12"
Ram movement 19"



HORIZONTAL . . . ANGULAR . . . VERTICAL MILLING

One Van Norman Ram Universal Miller gives You the work range of several types of millers.

USE VAN NORMAN RAM-TYPE MILLING MACHINES

One machine tool that you won't have to worry about at reconversion time is a Van Norman *Ram-Type* Milling Machine . . . for this miller is so versatile that it enables you to perform any and every milling job from horizontal to vertical . . . simply by positioning the adjustable cutterhead which is mounted on a movable ram. Why do you benefit . . . because with this one machine you have the work range of several single purpose millers. This enables you to keep the Van Norman miller working practically all the time . . . also many jobs can be carried through to completion without changes in the workpiece setup — saving time and reducing errors.

Another reason the *Ram-Type* miller increases production is the front and rear directional control of power feeds and manual feeds . . . resulting in ease of operation, less worker fatigue since he doesn't have to run back and forth to line up or watch the cut.

The massive column, heavy-duty movable ram which has dovetail ways, and large knee, saddle and table assemblies provide exceptional rigidity which assures accuracy of every type of cut. In addition, such features as large, easy-to-read dials, single lever feed selector, conveniently located and easily reached speed selector, rugged Ram-Type overarm and arbor support, hardened alloy steel precision gears — all assure accuracy, economy and maximum production. Van Norman *Ram-Type* Millers are available in many models with plain or swiveling tables. Write for information, today.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

"It pays to Van Normanize"

How To Grind A Taper

FOR STRAIGHT GRINDING

Turn regulating wheel base swivel screw back to zero where base will be parallel to work axis and ready to grind. Hydraulic traverse of regulating wheel base speeds alignment of work rest blades. Manual plus hydraulic traverse permit quick alignment of regulating and grinding wheel for unmarred finishes.

LANDIS TOOL

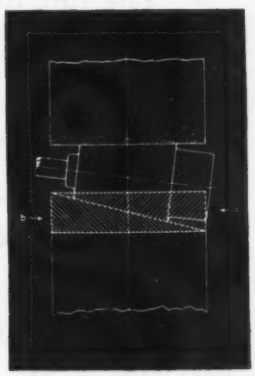
Precision Grinders

LANDIS TOOL COMPANY

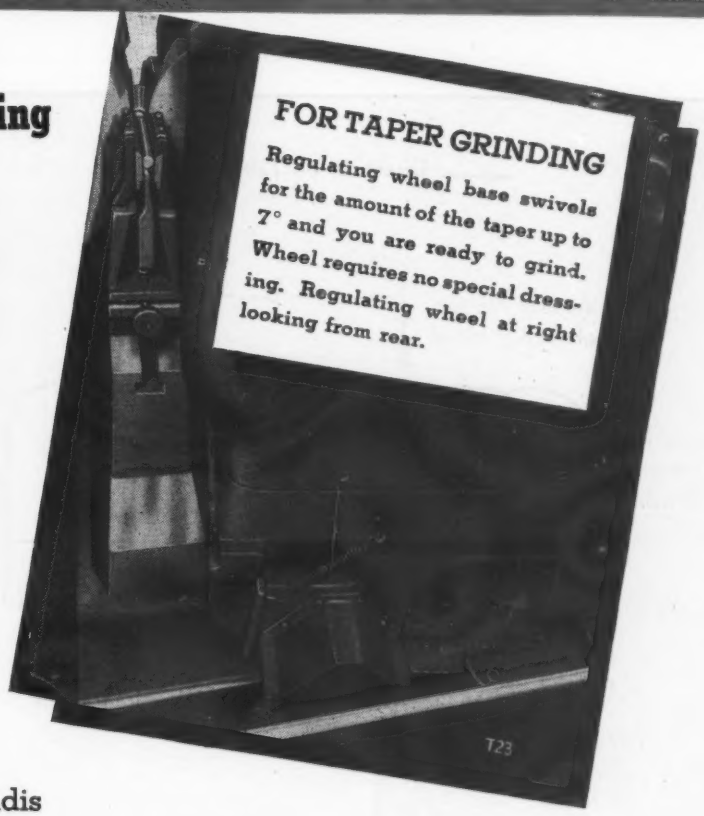
Without Diamonding The Wheel On LANDIS TOOL CENTERLESS

Why You Save Wheel Diamonding

Regulating wheel after swiveling showing position for grinding taper on Landis Tool Centerless.



Regulating wheel position for grinding taper if it could not swivel. Sectioned areas show amount of wheel to be diamonded off for taper grinding (a) and additional amount to return to straight grinding (b). (Exaggerated slightly to bring out detail.)


FOR TAPER GRINDING
Regulating wheel base swivels for the amount of the taper up to 7° and you are ready to grind. Wheel requires no special dressing. Regulating wheel at right looking from rear.
T23

• Tapers can be ground on the Landis Tool Centerless Grinder with big savings in time and money. The swiveling feature of the regulating wheel base makes it possible to grind tapers up to 7° merely by changing the setting of the wheel base by means of the calibrated regulating wheel base swivel screw.

You save the time of diamonding the regulating wheel. Not only the time required to put on the original taper but also the time of removing it so that straight work can be done plus the longer diamond life which results. You also save on the Landis Tool Centerless because of longer regulating wheel life, since none of the wheel must be removed to grind the taper.

Finishes will be better, too, when tapers are ground the Landis Tool way by swiveling the regulating wheel base. The peripheral speed is constant, force exerted on the work is equal and there is no slippage.

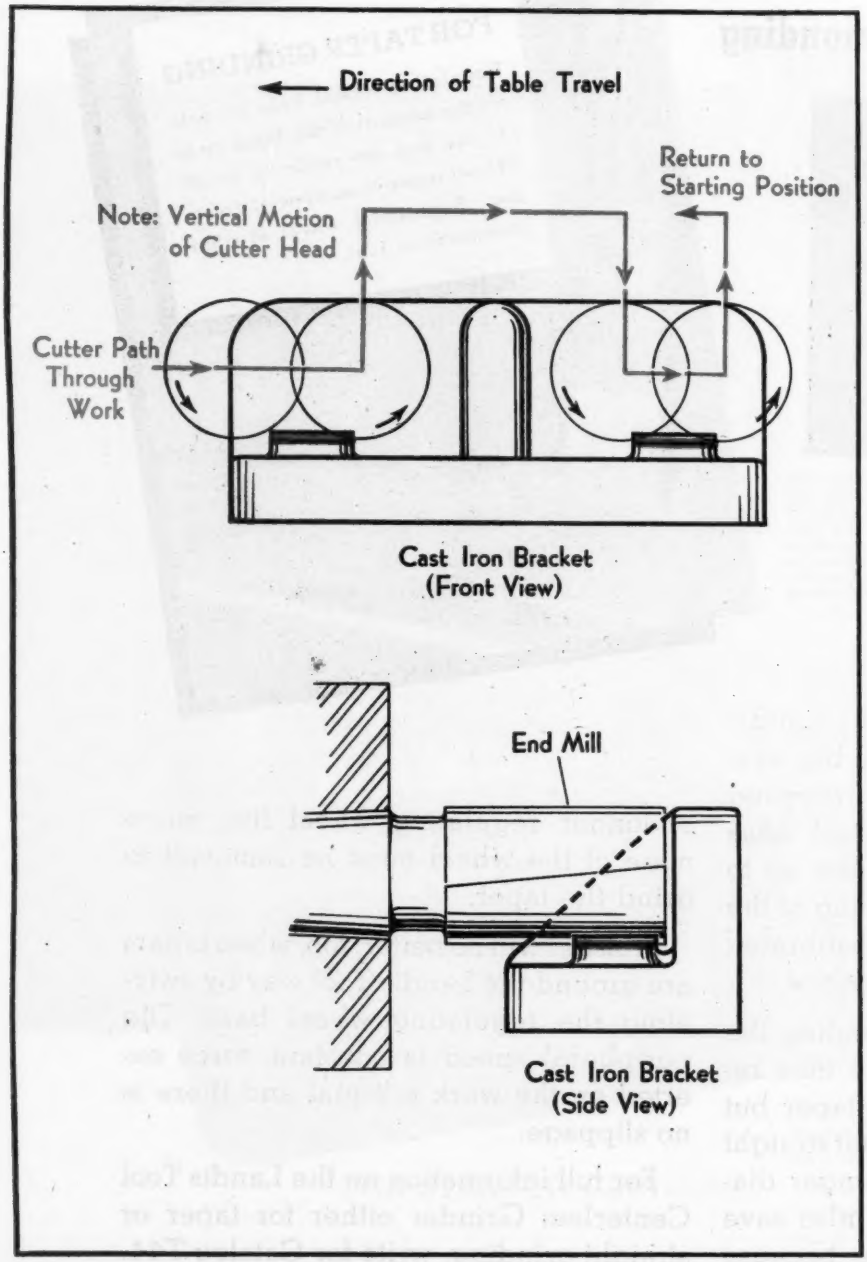
For full information on the Landis Tool Centerless Grinder either for taper or straight grinding, write for Catalog T44.

40

LANDIS TOOL Company

WAYNESBORO, PA.

Simple Application of the U. S.


Direction of Table Travel
Return to Starting Position
Note: Vertical Motion of Cutter Head
Cutter Path Through Work
Cast Iron Bracket (Front View)
End Mill
Cast Iron Bracket (Side View)

The line drawings (at the left) are the front and side views of a cast iron angle bracket with a central rib. At either side of the rib, on the horizontal portion of the bracket, there is a circular boss, the top of which is to be milled. The milling of the two bosses is easily handled on an MM-1-5-2 U. S. Multi-Miller utilizing an inexpensive clamping fixture — no indexing is required. The MM-1-5-2 U. S. Multi-Miller, as shown in photograph is arranged with automatic, cam controlled, rise and fall motion of the spindle head. The table feed of the machine is also cam controlled, and operates in synchronization with the head movement to produce the desired result.

U. S. TOOL

AMPERE (EAST

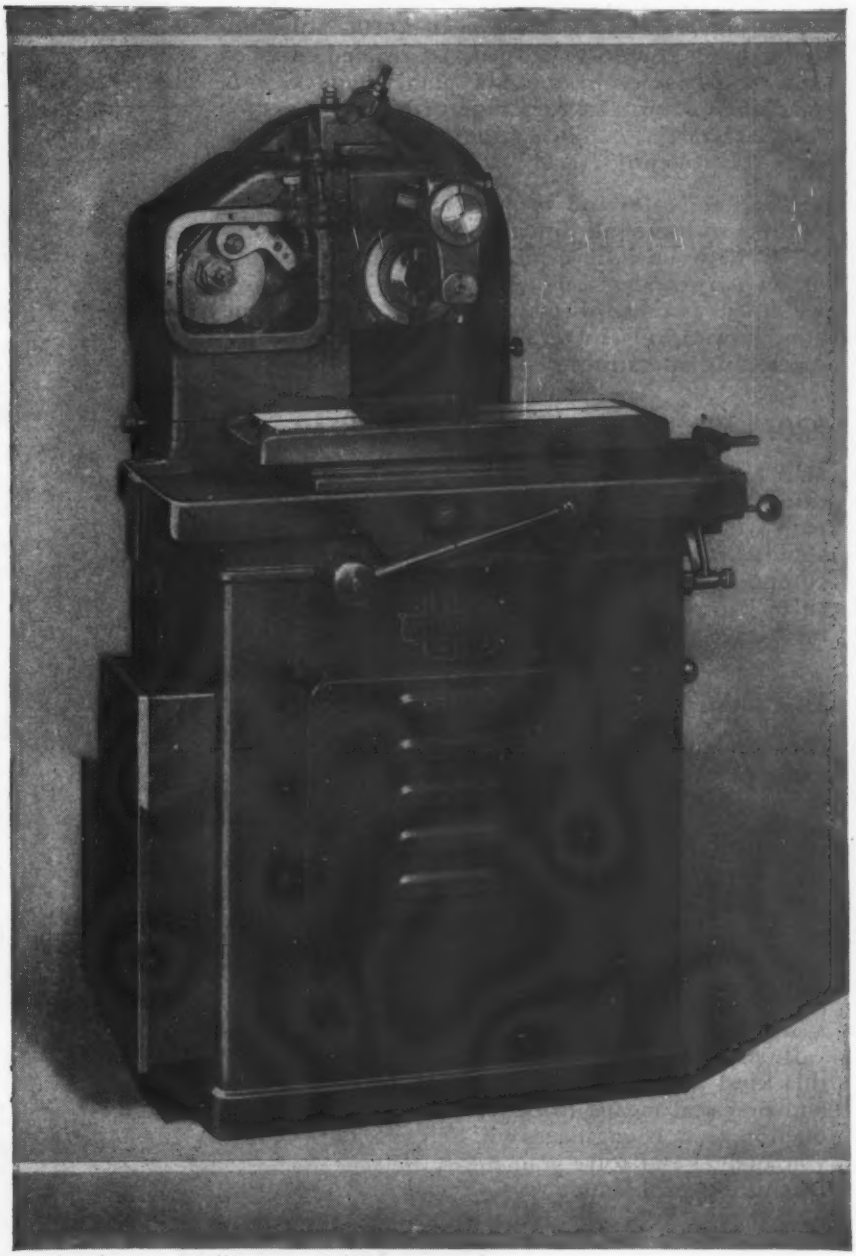
Builders of U. S. MULTI MILLERS
U. S. MULTI SLIDES

Multi Miller

METHOD EMPLOYS INEXPENSIVE CLAMPING FIXTURE

The line drawing shows direction of table movement from right to left — i.e., the apparent travel of the cutter through the work is from left to right. It will be observed that after milling the first boss, the spindle head automatically raises so that the cutter may clear the central rib. When in correct position above the second boss, the spindle head automatically descends and the second boss is milled. The head again ascends and the machine table returns rapidly to starting position.

Our General Catalog contains complete specifications for the U. S. Multi-Millers. Ask for your copy. Quotation will be sent on receipt of part prints or samples.



COMPANY, INC.

ORANGE), N. J.

U. S. AUTOMATIC PRESS ROOM EQUIPMENT
U. S. DIE SETS AND ACCESSORIES

215 INDIVIDUAL OPERATIONS MADE IN

No Prior Work Layout Required—Machining Simplified

■ Twenty-four surfaces are milled, 100 holes are drilled, 37 bored, 35 tapped, 10 reamed, 8 faced and one counterbored on a planer type G. & L. machine to complete this huge revolving frame for final assembly. All operations are performed in only three settings.

Machine scales and verniers are depended upon entirely to locate all dimensions which are held to .002" between bore centers and on pad faces. *No preliminary layout work is required.* The massive weldment is taken directly to the G. & L. machine after fabrication and is mounted on the table for machining operations.

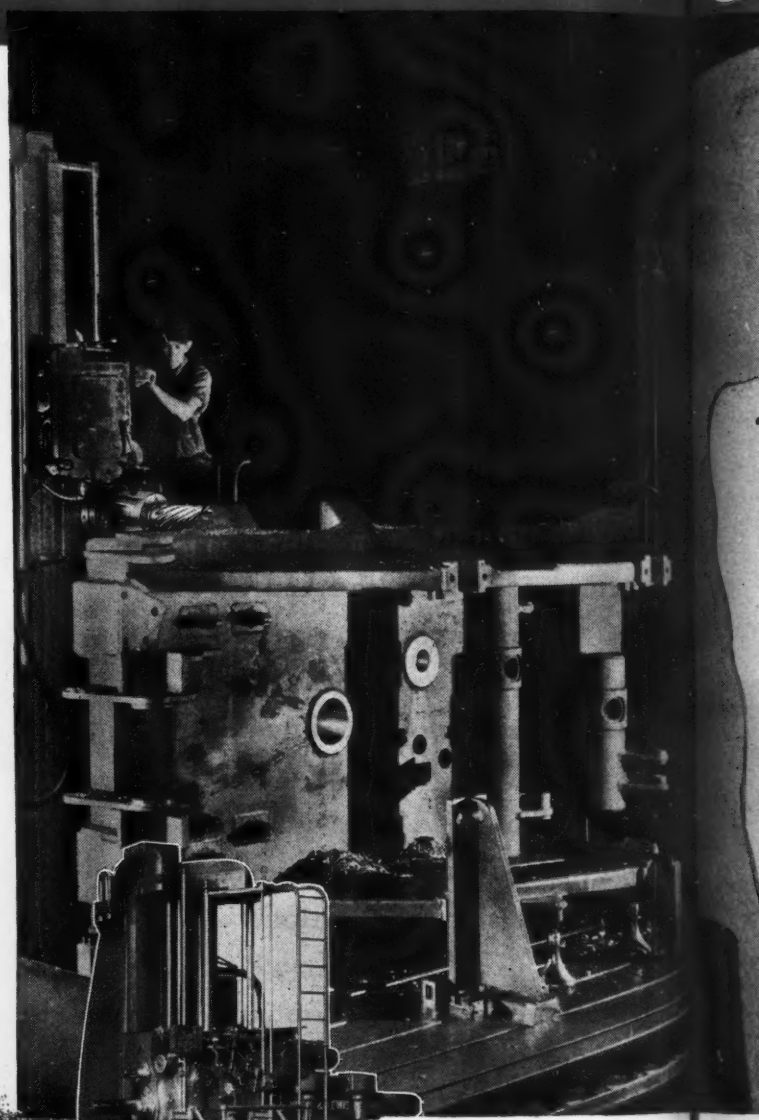
PROFILING USED TO MACHINE CIRCULAR PAD

G. & L. headstock and table feeds used in combination make it possible to profile the circular roller path without difficulty. Headstock feed is engaged simultaneously with table feed. As a result of this compound feed movement, the cutter mills the circular path of the roller pad to the required dimensions.

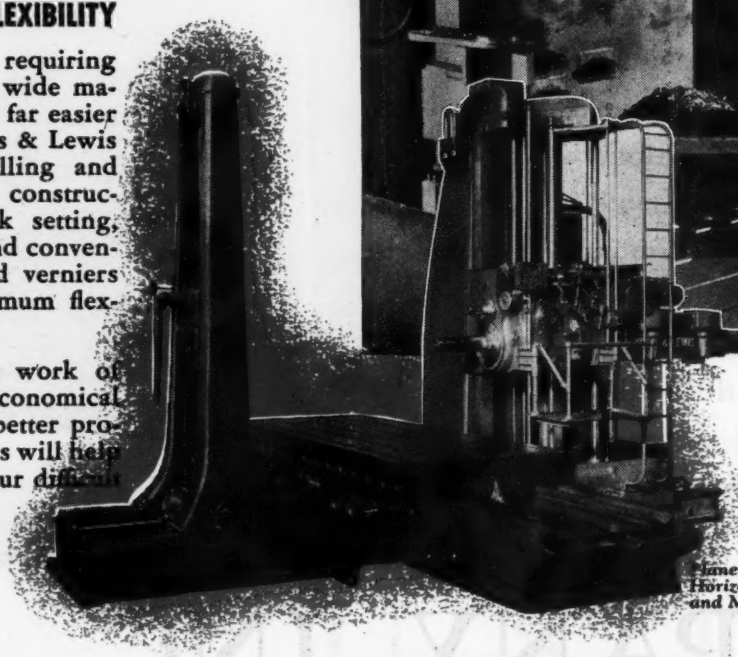
MAXIMUM MACHINE FLEXIBILITY

Large complex work requiring multiple operations and wide machining range is handled far easier and better on a Giddings & Lewis Horizontal Boring, Drilling and Milling Machine. Open construction, simplicity of work setting, accuracy of operations and conveniently located scales and verniers give this machine maximum flexibility and versatility.

If you are producing work of this kind and seek an economical and practical means to better production, G. & L. engineers will help you analyze and solve your difficult machining problems.



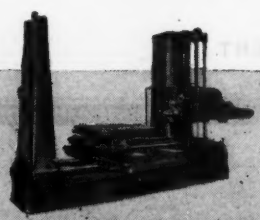
Giddings & Lewis 360-P Planer Type Machine with work mounted on table.



Planer Type Giddings & Lewis Horizontal Boring, Drilling and Milling Machine.

GIDDINGS & LEWIS

140 DOTY STREET



Right: G. & L. Table Type Machine.

Right: G. & L. Floor Type Machine.

3 SIMPLE SETTINGS OF THIS HUGE FRAME

G. & L. Scales and Verniers Permit Work Within the .002" Limits Required

COMPLETE OPERATIONS

FIRST SETTING:

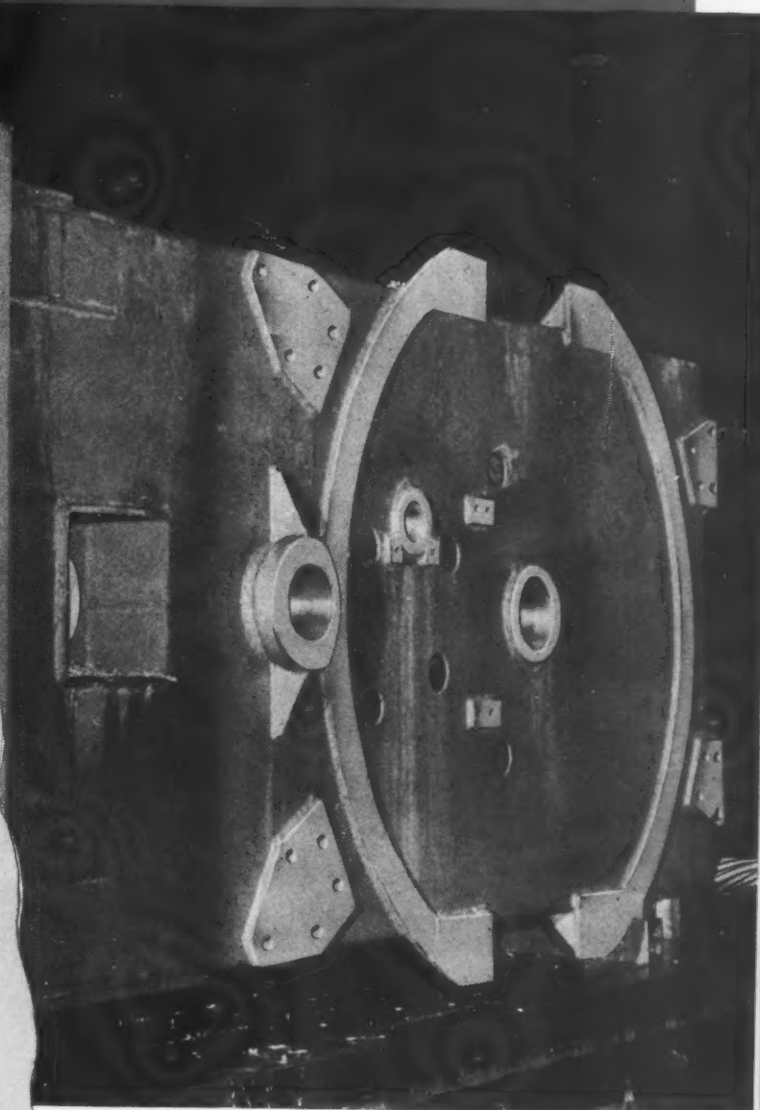
Mill twelve pads, and roller path; bore 8.125", 9.374", 4.751", 8.250", 5.500" holes; drill and tap five 3/4"—10 holes; drill ten 1 1/16" holes, two 5/16" holes; drill and ream one 1 1/2" hole; drill six 1 5/16" holes; drill twelve 1 9/16" holes.

SECOND SETTING:

Mill four pads for motor base, six bearings, and pedestal stand; counterbore 5.904" diameter.

THIRD SETTING:

Bore and face 11.499", 7.752", 9.250", 6.125", four 7.125" holes; drill and bore four 2 25/32" holes, two 2 1/32" holes, six 1.752" holes, four 2.002" holes; drill and ream 1.499" hole; drill, bore and ream two 2.450" holes, six 2.937" holes; drill and tap thirty 5/8"—11 holes; and drill nine 2 3/32" holes.



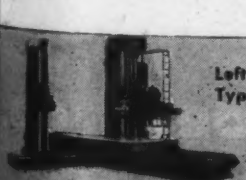
Revolving Top Frame for Excavator in first work position.

FREE Field Production Facts

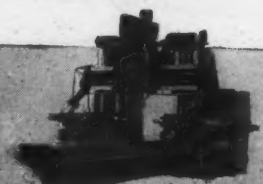
will help you solve difficult machining problems. Write today for your copy of Trade Journal Advertising MA140, covering advanced G. & L. machining methods. Please indicate your business connection.

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WIS.

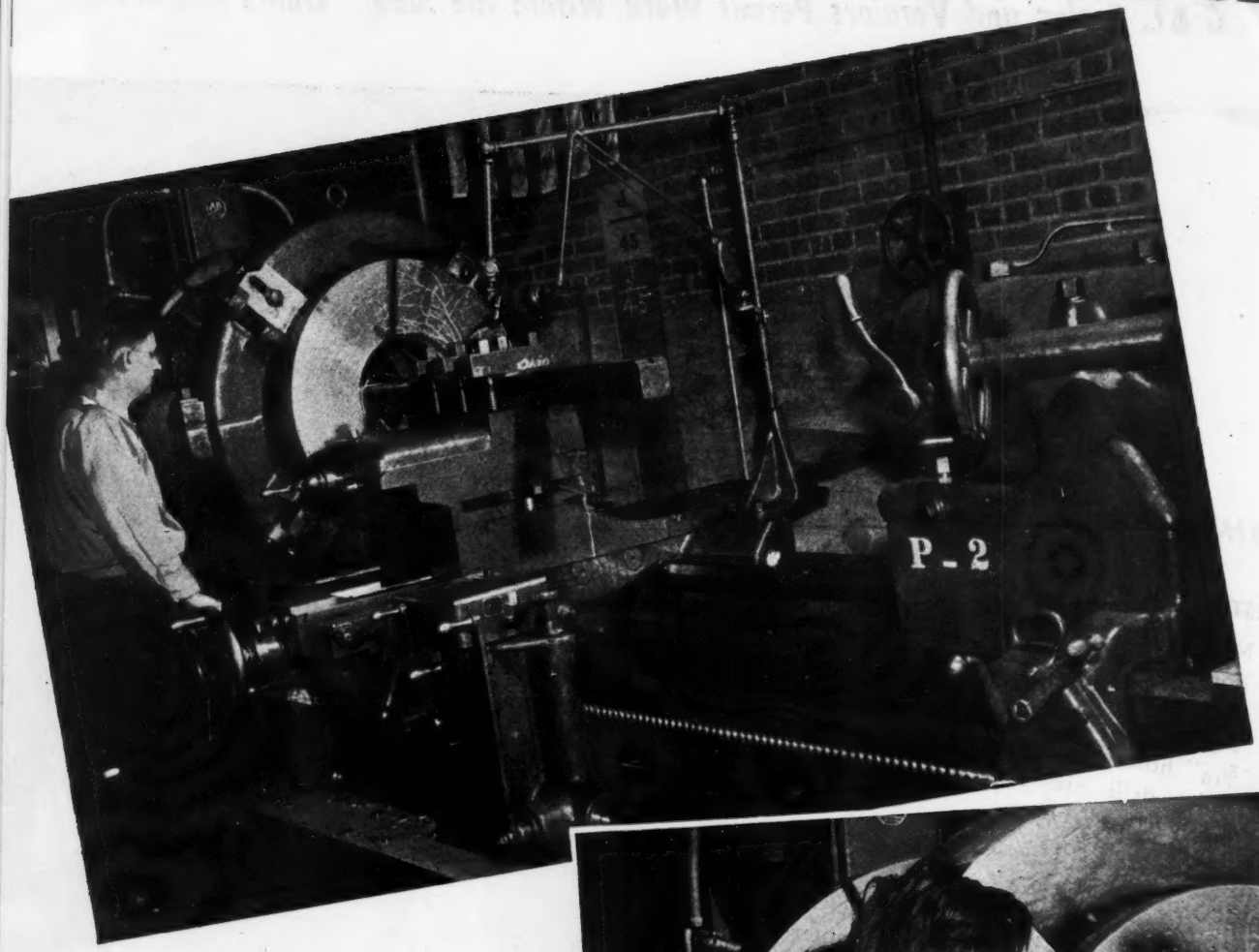


Left: G. & L. Planer Type Machine



Left: G. & L. Multiple Head Type Machine

Like all True A



THE AMERICAN TOOL WORKS CO

AMERICANS...

"AMERICAN" Lathes, from the smallest to the largest, are meeting the challenge of production like all true Americans. The power, stamina and endurance built into "American" Lathes have proven invaluable to many a production plant operating on an around-the-clock schedule. Dependable service, minimum shut-down for failures and repairs, coupled with an almost unbelievable ability to "keep going" under any and all conditions, are genuine "American" characteristics. "American" Lathes are easy to operate, too—another feature that appeals to the operator as do their simplicity of design and complete freedom from complex mechanisms and manipulations.

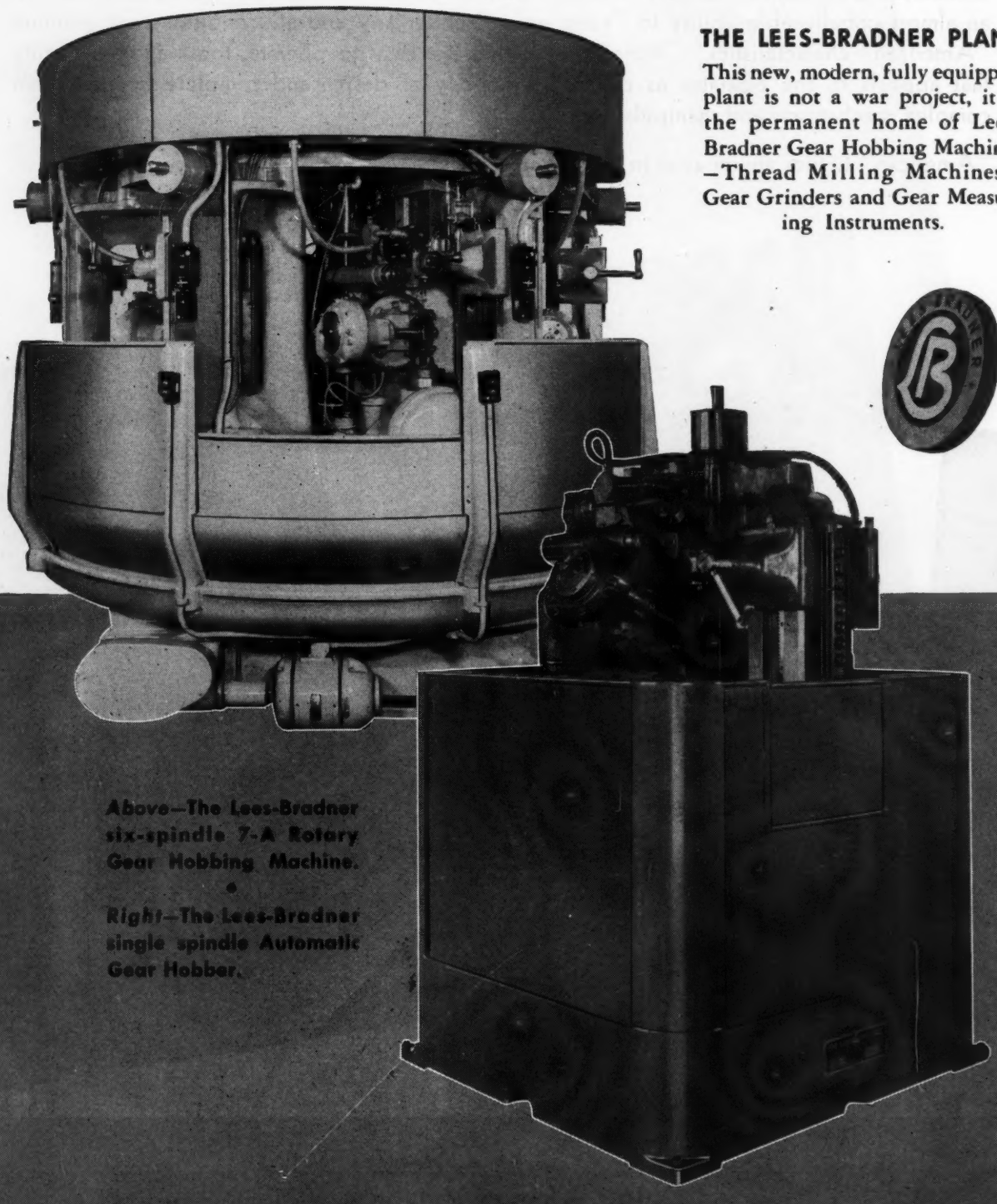
"American" Lathes are an asset in any plant.

• *Send for Bulletin No. 87*

Lathes and Radial Drills **Cincinnati, Ohio U.S.A.**

THE LEES-BRADNER PLANT

This new, modern, fully equipped plant is not a war project, it is the permanent home of Lees-Bradner Gear Hobbing Machines—Thread Milling Machines—Gear Grinders and Gear Measuring Instruments.



Above—The Lees-Bradner six-spindle 7-A Rotary Gear Hobbing Machine.

•

***Right*—The Lees-Bradner single spindle Automatic Gear Hobber.**

KEEP IN THE LEAD WITH

Lees-Bradner

HOBBING MACHINES

Rotary and Single Spindle

● Lees-Bradner pioneers of modern high production gear hobbing originated and developed this line of precision machines. The Rotary is built in 4-6 and 8 spindles and is used for the generation of spur and helical gears, sprockets and splines.

Operation is extremely simple as operator merely loads machine, presses a button and all other functions are performed automatically by the machine.

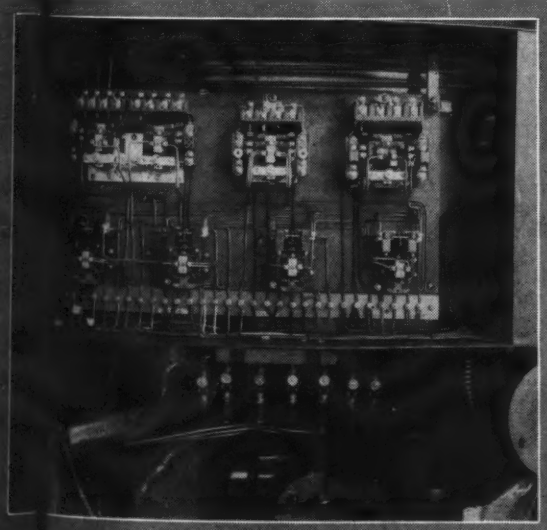
The Rotary is generally speaking a mass production machine and is ideal for the high production of a single job. However it will also handle several different jobs simultaneously, completing a piece in the time of one revolution of the table. Because of this flexibility the Rotary is adaptable to work on which the production might seem too low at first glance.

The Single Spindle Automatic Gear Hobber is also a high production machine of extreme accuracy. It will cut straight serrations, spline shafts, spur gears, helical gears—right or left hand angles up to 45 degrees. It has a capacity for gears up to 7 inches outside diameter and 9 inches face and pitches up to 4 diametral pitch in steel.

The operation of the machine is very simple—does not require skilled help—one operator can handle a battery of machines. The operator merely places work in the machine, presses a button and unloads the finished piece at the end of the cycle.

A battery of Lees-Bradner Production Hobbers at a prominent automotive plant had only 4 rejects out of 750,000 gears inspected. Records like this indicate how well these rugged machines maintain precision requirements and high production.

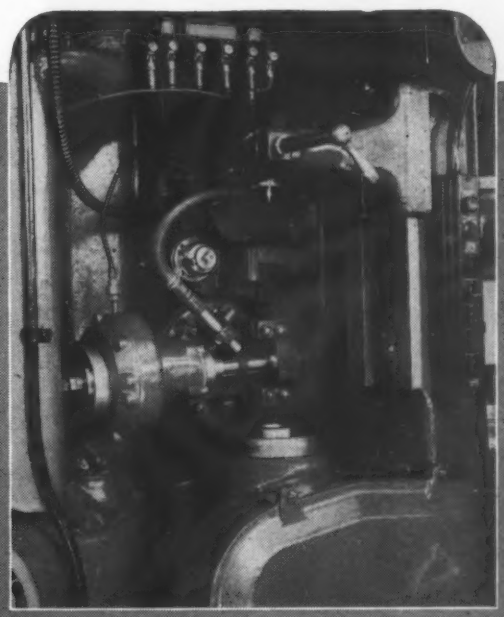
Consult Lees-Bradner on your precision hobbing work.



Left—Electric Panel arrangement for Rotary Gear Hobbing Machine.

●

Right—Close up of Hob Head—Work Spindle—and Push Button Control Switch.



The LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.

JACOBS PRODUCTION CHUCKS
with the RUBBER-FLEX COLLET
"THE COLLET WITH A RANGE"

NOW is the time to profit by this unique development in chuck design that brings modern efficiency and economy to manufacturing – especially in the operation of multiple spindle machines doing heavy duty drilling and reaming.

Jacobs Production Chucks – small in diameter and consistent in accuracy – provide three salient advantages: 1 Ability to handle an unusually wide range of drill sizes. 2 Extreme simplicity which features the Rubber-Flex Collet of one-piece construction ground as a unit after molding. 3 Ever-parallel jaw gripping surfaces that assure full-length hold on drill or reamer shanks.

The entire unit is sturdy – contains only four simple parts – stands unusual use and abuse without loss of accuracy or gripping power. The chuck socket receives the flatted tang of the drill and will take all drills having the same flat size. On most applications – because of the tenacious grip of the Rubber-Flex Collet – standard drills can be used without slippage!

12 OR 300?

12 Jacobs Production Chucks and 3 Arbors Cover More Than 300 Single Purpose Chuck Applications!

DESIGNED FOR POSTWAR ECONOMY
PERMIT DRASTIC REDUCTION IN TOOL INVENTORY COSTS

Featuring **"THE COLLET WITH A RANGE"**

Here's how the new design and construction principle of the Rubber-Flex Collet will bring substantial savings in tool inventory and operating costs and assure long-sustained accuracy to your machine operations:

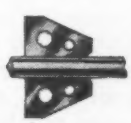
The multiple jaws accurately spaced **in opposing position are made of hardened alloy tool steel.**

They are molded in a special compound of oil resisting **Neoprene and are internally and externally ground after molding.**

At rest, the Neoprene holds jaws parallel and ready to receive or to release **the drill shank. It is now in the position of maximum capacity.**

When chuck is tightened the Neoprene is **displaced and the jaws close, gripping the drill shank firmly.**

At maximum capacity **jaws are always parallel and have a full length bearing.**

At minimum capacity, the jaw bites are still precisely parallel  **and have a full length bearing.**

Write for Special Bulletin P4 today. The Jacobs Manufacturing Co., Hartford 2, Connecticut.

Jacobs Chucks

THE NATIONAL STANDARD FOR POST WAR PRODUCTION

WHAT IS YOUR ULTIMATE MANUFACTURING RESPONSIBILITY?

DEVELOPMENT?

ENGINEERING

SERVICE?

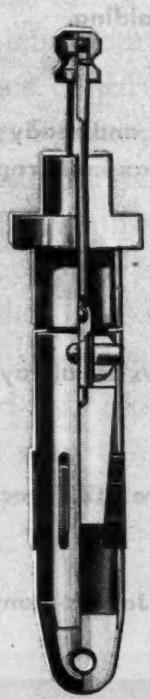
PRODUCTION?

Isn't it Distribution?

All of the intended benefits and usefulness of your product—the brain-beating which conceived and fashioned it; the sweat, toil and risk-taking which produced it—depend upon your determination to put improved quality products into the hands of the most users at the lowest possible price. The ultimate success of your enterprise depends on balanced, economical distribution of its results.

Production economy is usually considered a necessary first step in distribution economy; and, in view of the recently increased rate of technological development, it is logical first to explore all possibilities for maintaining low unit costs of production. With probable higher labor costs ahead of us, it is evident that we can attain low production cost per man-hour only through improved machinery, improved methods of processing and improved methods of distribution.

Micromatic Microhoning—the newest desirable, high production method of final precision machining of cylinder bores—has already made substantial



improvements in quality, and cost reductions in a wide range of products in the automotive, aircraft, diesel, refrigeration, compressor, anti-friction bearings and other manufacturing industries. It can remove a large amount of metal without damaging the subsurface structure; it has eliminated one or two steps in the final processing of cylinder bores in many parts.

In this processing, a tool carrying several abrasive sticks is revolved while also being stroked in a simple or compound reciprocating motion. Applicable to internal and some external cylindrical surfaces, it removes metal at rates ranging up to .008 to .010 on diameter per minute; and in quantity up to .070 to .080 on diameter, or volume as high as 75 cubic inches per hour. It corrects errors of previous processing and generates true roundness, bore wall and axial straightness in a majority of applications within tolerances ranging from .0001 to .0005. It is available with automatic size control which holds size uniformity within .0001 to .0003 in high production.

MICROMATIC HONE CORPORATION

DETROIT 4, MICHIGAN

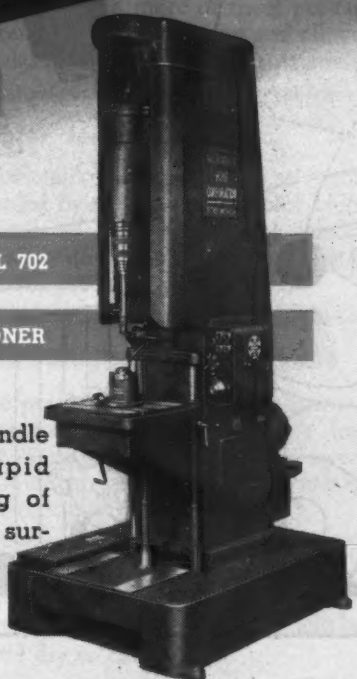
FUNDAMENTAL TO LOWER COST, VOLUME PRODUCTION ARE MODERN TOOLS SUCH AS

MICROMATIC HONING MACHINES

Industry after the war will need modern production tools as much as it will need modern distribution methods. Micromatic Honing Machines have developed rapidly to ultra-modern, high speed tools for final precision machining.

MICROMATIC MODEL 702

VERTICAL HYDROHONER



Standard single spindle type—built for rapid production honing of bores or cylindrical surfaces up to 2" in diameter.

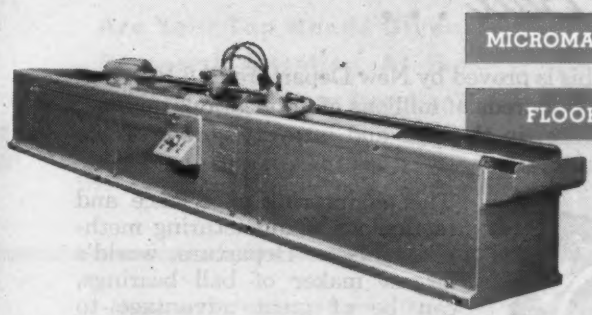
MICROMATIC MODEL 705 MULTIPLE

SPINDLE VERTICAL HYDROHONER

with built-in automatic Microsize Control. For internal honing. Rotary indexing work table provides high production. Usually recommended for maximum stock removal ranging from .0005" to .0015" on hardened parts—.001" to .010" on soft or medium hard. Bores from ¼" to 2" diameter. Microsize control gauges work automatically. Work is held uniformly within tolerances of .0003". Honing cycle is automatically stopped when correct size is reached.

MICROMATIC HORIZONTAL

FLOOR TYPE HYDROHONER



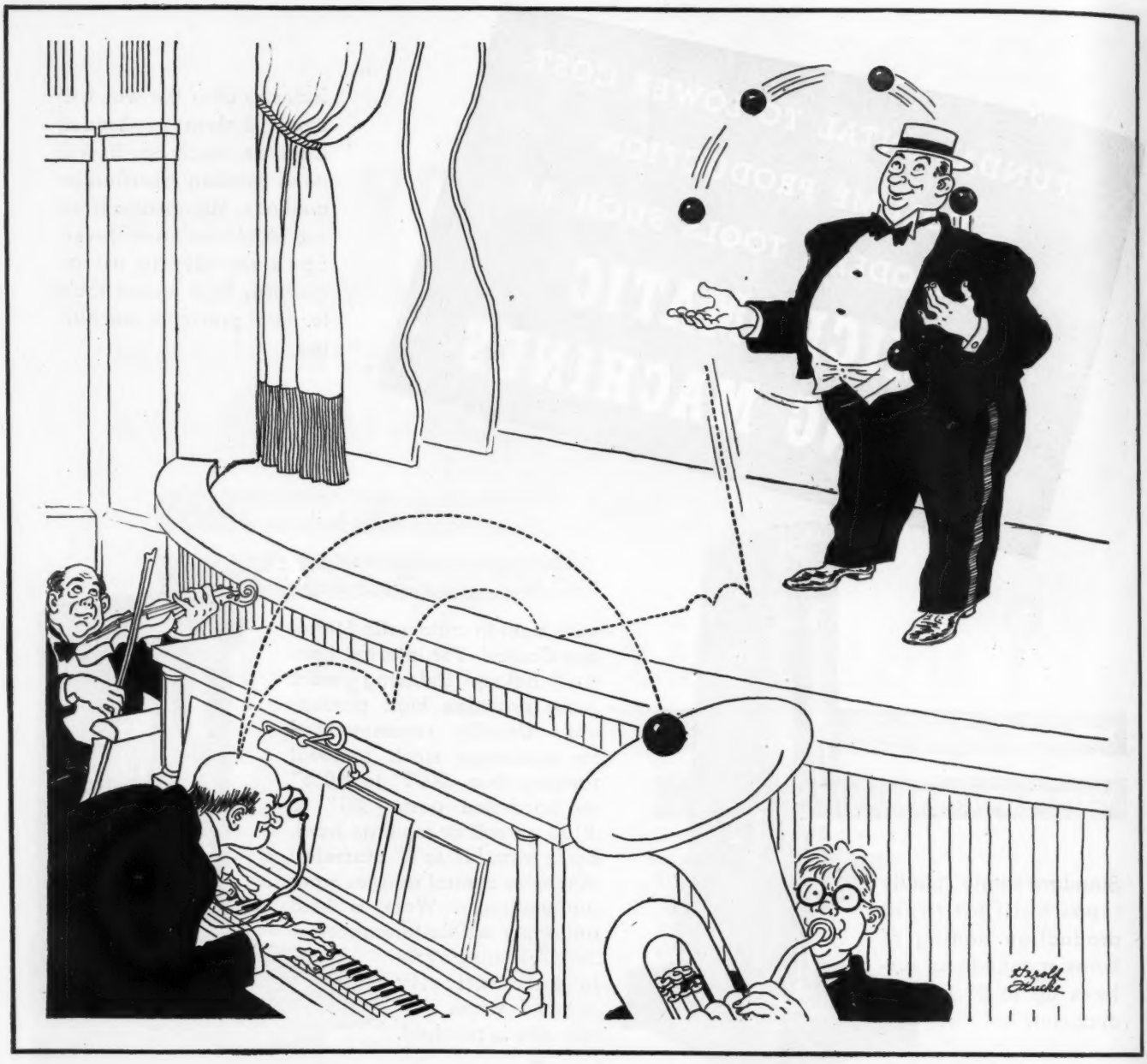
for internal or external honing. Tool operates either under hydraulic or manual control. Tools available to generate either crosshatch or co-directional finish patterns. Full floating tool action. Stock removal .0015" to .002"—precision generated size limits .0003". Corrects error for taper to within .0001" limit. Size of work accommodated 1" up.

MICRO MATIC

MICROMATIC HONE CORPORATION

DETROIT 4, MICHIGAN

DISTRICT OFFICES: 614 Empire Building, 208 South Main St., Rockford, Illinois • 129 Church St., New Haven 10, Connecticut
501 Harries Building, 137 North Main St., Dayton, Ohio • 1031 South Broadway, Los Angeles 15, California



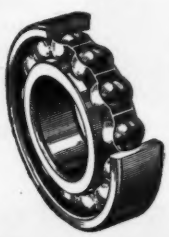
Nothing Rolls Like a Ball . . .

. . . and that fundamental fact has just struck the piano player!

Machine designers, too, have been impressed by that fact. A ball has no ends, needs no artificially fixed axis of rotation. It is nature's favorite, strongest form.

Hence the *ball* bearing. It carries the loads on free-rolling steel balls. It is just *naturally* adapted to our new world of high speeds, heavier loads and ever greater precision.

This is proved by New Departure Ball Bearings in hundreds of millions of applications on land, at sea, in the air—and in every corner of the world.



The engineering experience and meticulous manufacturing methods of New Departure, world's largest maker of ball bearings, can be of great advantage to you.

There is more for you in New Departure Ball Bearings than steel and precision. Advanced engineering and a desire to serve are tangible plus values.

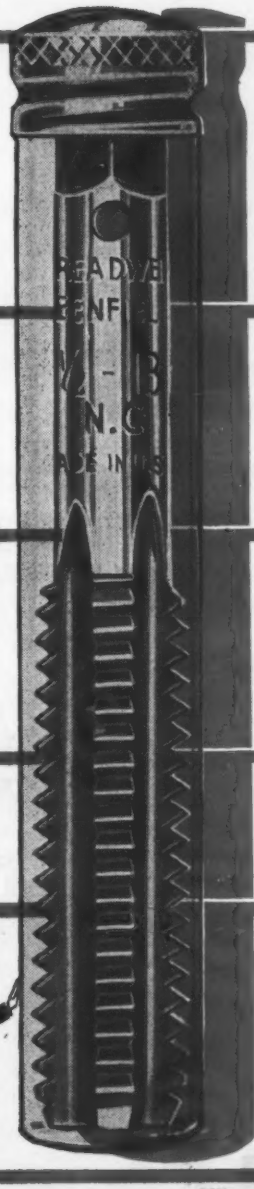
NEW DEPARTURE
BALL BEARINGS

3387

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN. • Branches in DETROIT • CHICAGO • LOS ANGELES and Other Principal Cities

CHECK Your TAPS ON THESE 5 COUNTS

Your high speed taps may be well and accurately made. But why let it go at that when, today, you can get so much more for the same money. Before you buy, ask yourself these questions:



1 Are They COLD-TEMPER Taps?

Deep-freeze treatment at 120° below zero in addition to the usual heat treatment makes taps stronger but less brittle. COLD-TEMPER Taps produce cleaner, better threads and more of them per tap —not only on steels, cast iron and alloys, but on plastics and other abrasive materials.

Only *Threadwell* Taps are COLD-TEMPER Taps.

2 Are They Color "i-dot-ified"?

Taps look alike. Errors in tap selection are avoided by modern use of color identification—*red* dot on the shank for cut thread, *white* dot for commercial ground, *blue* dot for precision ground.

Only *Threadwell* Taps have "i-dot-ification."

3 Are They Individually Plastic Packed?

Taps are precision tools. They merit complete protection against dirt, dust and damage. Transparent plastic provides perfect individual protection and permits ready selection without unwrapping.

Only *Threadwell* Ground Thread Taps come in the metal-capped *tap-capsule.*

4 Are They Greaseless Rust-Proofed?

For speed and convenience, taps should be clean and dry to handle.

Threadwell taps have a special greaseless rust-proofing.

5 Are Your Tap Needs Given Personal Attention At the Factory and By Your Supplier?

Threadwell personal attention service applies to every order, large or small. The Threadwell distributor in your locality has been carefully selected for his ability to provide that kind of service. May we put you in touch with him?

DISTRIBUTORS IN LEADING INDUSTRIAL CENTERS THROUGHOUT AMERICA
Export Distributors
Canada — Bridge Machinery Company, Montreal
England — Skylux, Ltd., London
Brazil — Alfredo Kramer & Cia. Ltda., Rio de Janeiro, Sao Paulo
Mexico — W. Picard, Mexico, D. F.
John H. Graham & Co., Inc. of New York City
THROUGHOUT THE REST OF THE WORLD

Threadwell
SINCE 1902
"TAPS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY · GREENFIELD, MASSACHUSETTS, U. S. A.

CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21

The Problem: SMALL LOT RUNS

TURRET LATHES, SADDLE AND RAM TYPES—CHUCKING AND BAR TOOLS—PRECISION TAPPING AND THREADING MACHINES

The Answer:

WARNER & SWASEYS!

RIGHT now, a great many plants are finding production demands changing from long to short runs, with profitable operation more and more dependent on ability to shift equipment quickly from one job to another.

Five factors enter into profitable small run production:

1. Speed and ease of changeover—to keep set-up time low.
2. Flexibility in tooling—to cover the widest range of operations possible with one set-up.
3. Dependability — to hold close tolerances without time-wasting trouble-shooting.
4. Ease of operation—to speed job through.
5. Low maintenance costs—to cut overhead that must be charged against each job.

If you'll check up on your own experience with Warner & Swaseys—or the experiences of others—you'll find that they prove to be at or near the head of the list on every one of these five counts!

Why not let a Warner & Swasey Field Engineer show you how the quick adaptability of Warner & Swaseys provides the answer to the problem of maintaining profits in the days ahead. When you plan your equipment investment, look beyond the immediate job in hand—to years of low-cost profitable operation with multi-purpose Warner & Swaseys.

WARNER & SWASEY Machine Tools *Cleveland*

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

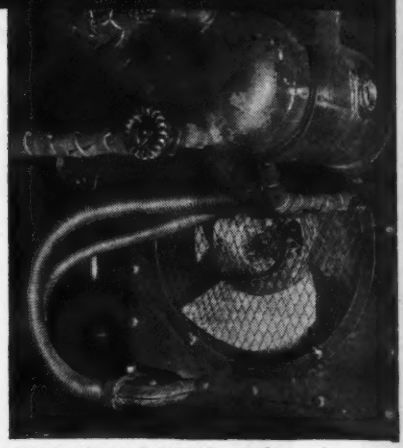
Flexible CONNECTIONS for *Postwar* PRODUCTS

Are you planning to manufacture new products or equipment in which gas... steam... oil or other fluids are conveyed through moving connections?

Then prevent such connections becoming trouble spots. Make adequate allowance for misalignment, movement, vibration... with connections of American Flexible Metal Hose or Seamless Flexible Metal Tubing.

Whatever may be the conditions of pressure, temperature, chemical, mechanical or abrasive action involved, a thoroughly dependable and durable "American" assembly can be engineered to fully meet your requirements.

For detailed information, write for Publication SS-50. 45267



REFRIGERANT LINES on this railway air conditioning unit must withstand abuse and vibration, and still remain pressure-tight. American Seamless meets these requirements, and permits unit to be rolled out for frequent inspection.

Buy VICTORY BONDS... Help assure World Peace

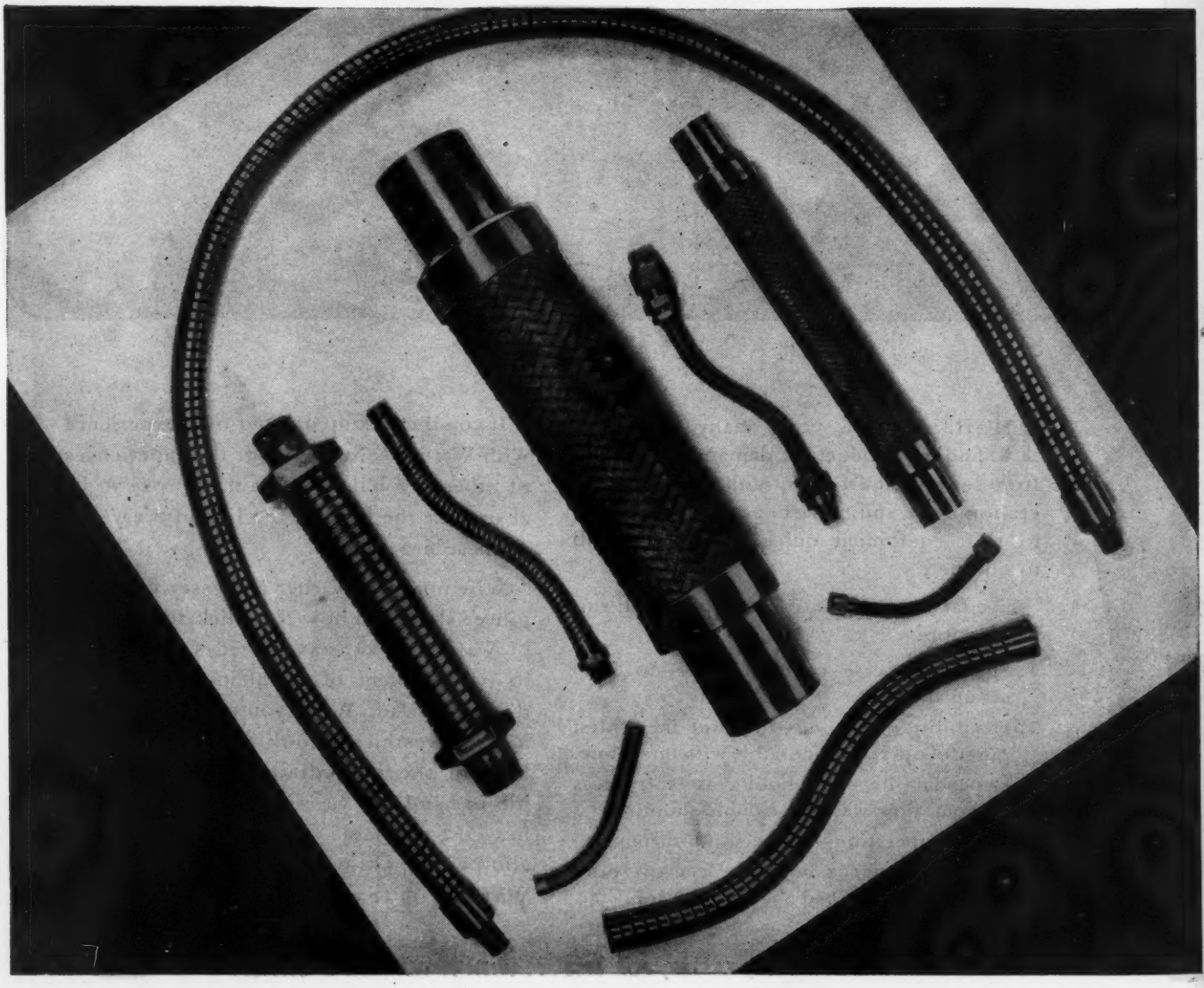
ANACONDA

American Metal Hose

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut • *Subsidiary of Anaconda Copper Mining Company*

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ontario*



LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

See this man with a plan...

that will improve your lubrication and cut maintenance

This man is a Standard Oil lubrication engineer. There's one near your plant if you are located in the states shown on the map.

His plan is Standard "Coded Lubrication Service"—a simple system that will help your oilers put the *right* lubricants in the *right* places.

This lubrication engineer will cooperate with your lubricating men, recommend better lubricants where they are needed, and help solve knotty lubricating problems. He will explain Standard "Coded Lubrication" and show how it can be applied in your plant or fitted into your present lubricating plan.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the engineer nearest you.

SO CO 1 CODED SO CO 2 LUBRICATION

Buy and hold more Victory Bonds

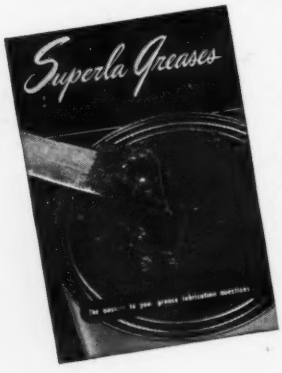
STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...

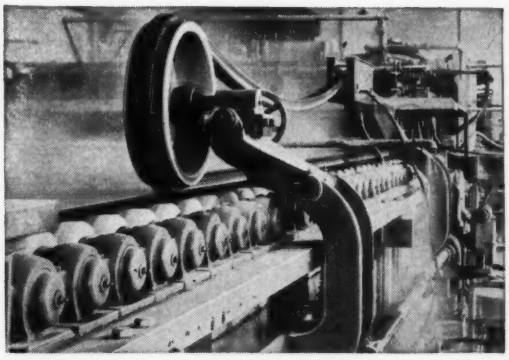
On wet, hot or dusty jobs... get better lubrication with

SUPERLA GREASES

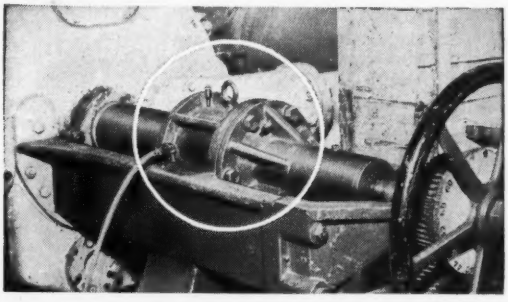
Superla Greases are available in two types and a wide range of grades. You will therefore find them the answer to better lubrication of anti-friction bearings under many operating conditions.



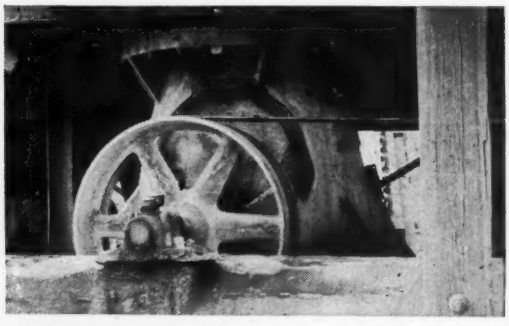
Just a few examples are briefly described here. The booklet gives more details of the properties and qualities of Superla Greases. It may help you save maintenance and money by showing you how to reduce bearing failures. Write Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago (80), Illinois, for a free copy of the booklet.



WET Wet-end roll bearings on paper mills are particularly difficult to lubricate because they are subjected to a constant shower of water. They require a high grade moisture-resistant lubricant such as Superla Numbered Greases, which are lubricating many installations of this type.



HOT In Jordan bearings, pressures are high and excessive temperatures frequently occur. The high grade Stern Stafford anti-friction bearings pictured above have been successfully lubricated for a number of years with high temperature Superla X Grease.



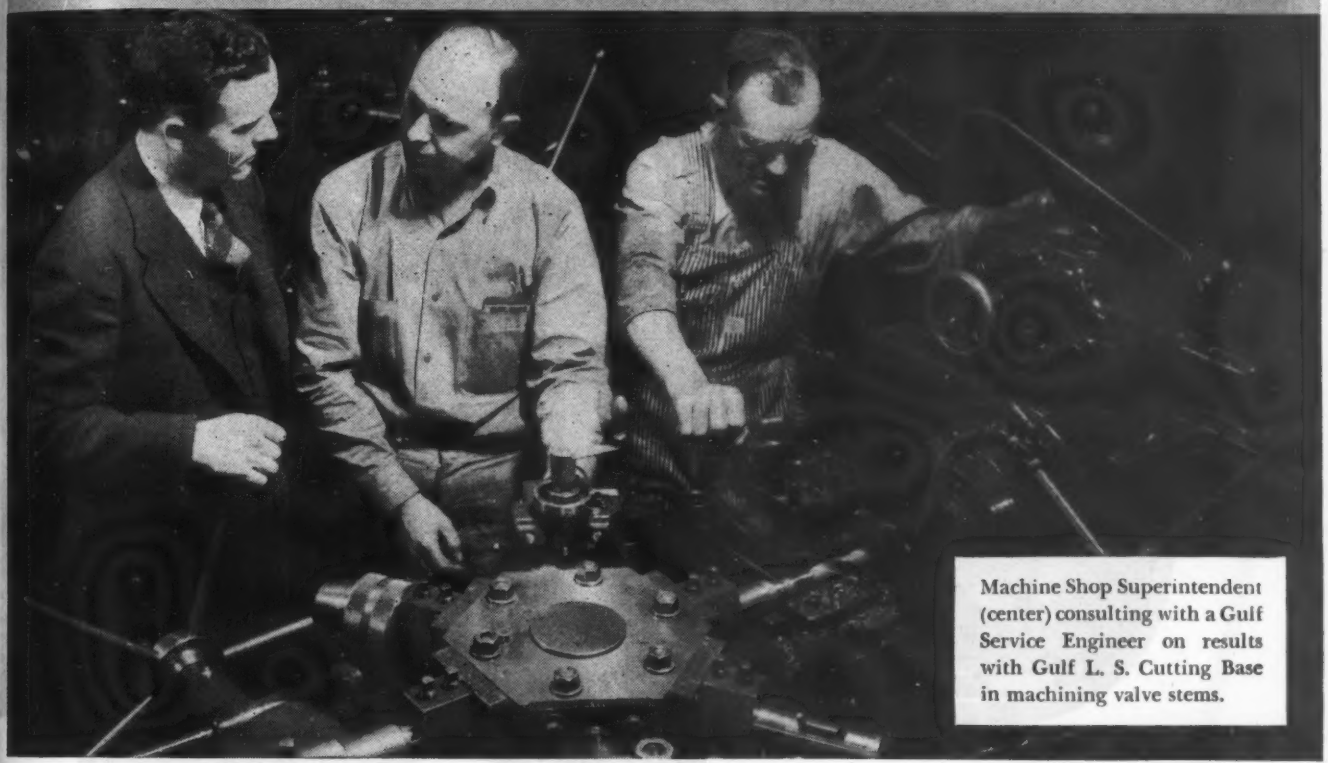
DUSTY Because all bearings can't be operated in air-conditioned surroundings, some, like the crusher bearings pictured above, need the all-weather protection of Superla Grease. Before Superla was used, these bearings twice needed replacing because of summer overheating, which allowed the grease to leak out and dust to get in. With Superla Grease, no bearings have failed, summer or winter.

Buy and hold more Victory Bonds

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

"With GULF CUTTING OILS we get greater production, longer tool life, and better finishes"

says this Superintendent



Machine Shop Superintendent (center) consulting with a Gulf Service Engineer on results with Gulf L. S. Cutting Base in machining valve stems.

"AFTER SWITCHING to Gulf Cutting Oils, we noted a general improvement all over the shop in production, tool life, and finish," says this Superintendent. "By the use of Gulf L. S. Cutting Base on this machine, we increased output about 40 per cent, and in addition secured longer tool life and a much better finish on the work."

Gulf quality cutting oils can give you a vital advantage in machining efficiency that may help you make substantial cuts in unit production costs. Here's the important reason: Every Gulf Cutting Oil has specific properties which insure better performance on certain types of machining jobs!

It will pay you to find out quickly the full possibilities of Gulf's production-proven cutting oils in your shop. Call in a Gulf Service Engineer today and let him show you how they can help you with your machining problems. Write, wire, or phone your nearest Gulf office. For your copy of the booklet "Gulf Cutting Oils," send the coupon below.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company

DIVISION SALES OFFICES:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

Gulf Oil Corporation · Gulf Refining Company M
3800 Gulf Building, Pittsburgh 30, Pa.

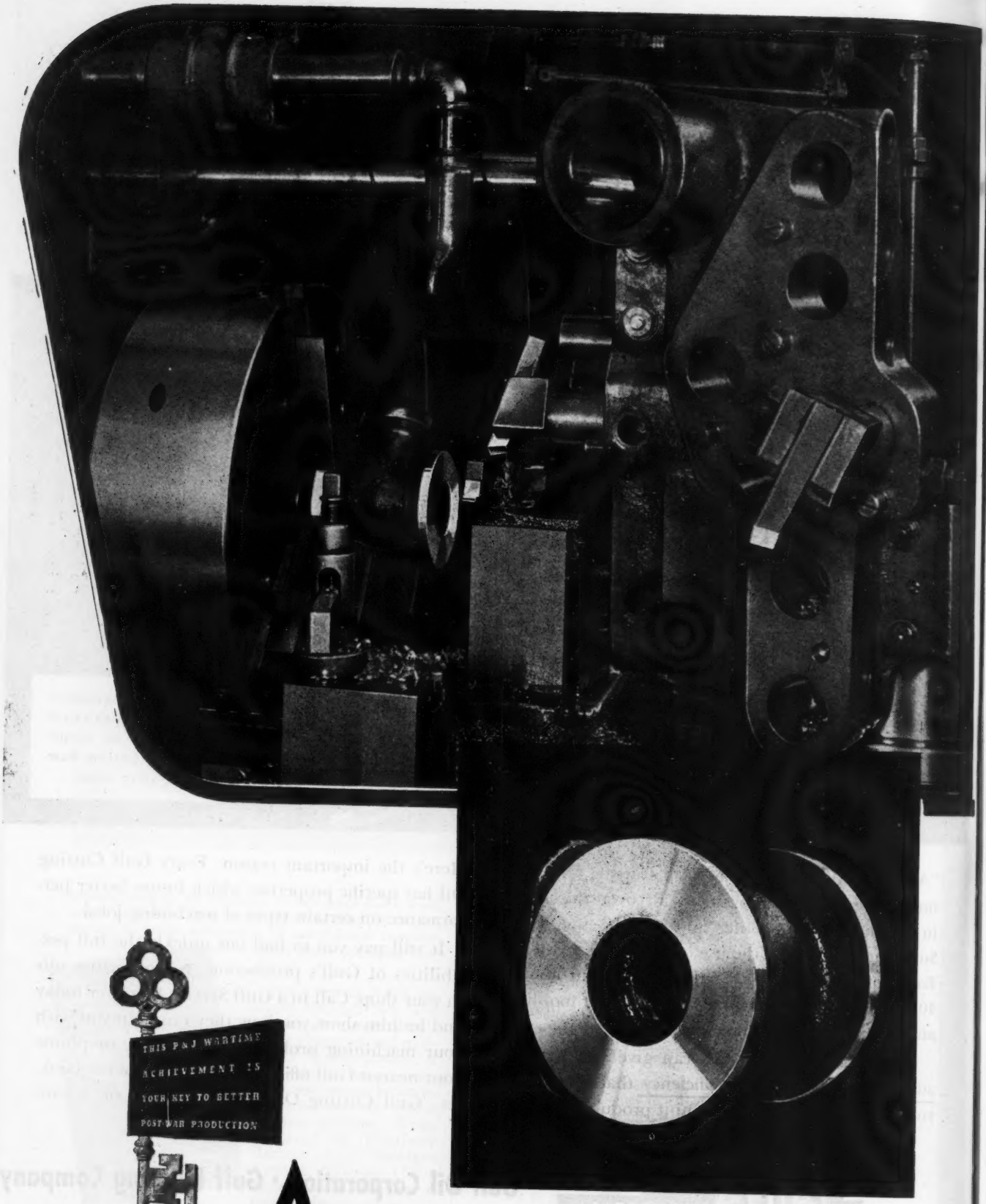
Please send me, without obligation, a copy of the booklet, "Gulf Cutting Oils," which includes a helpful Machining Guide.

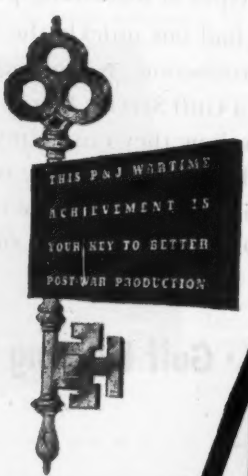
Name.....

Company.....

Title.....

Address.....





POTTER & JOHNSTON

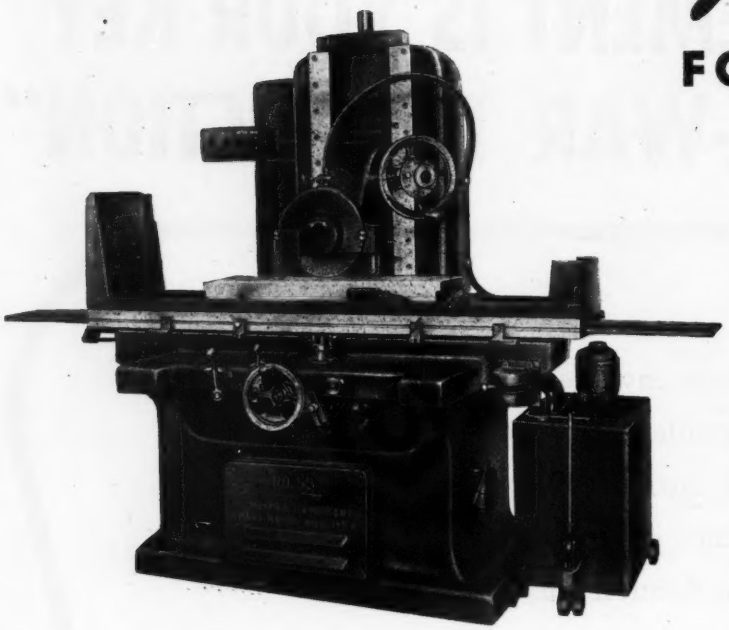
P&J Automatics

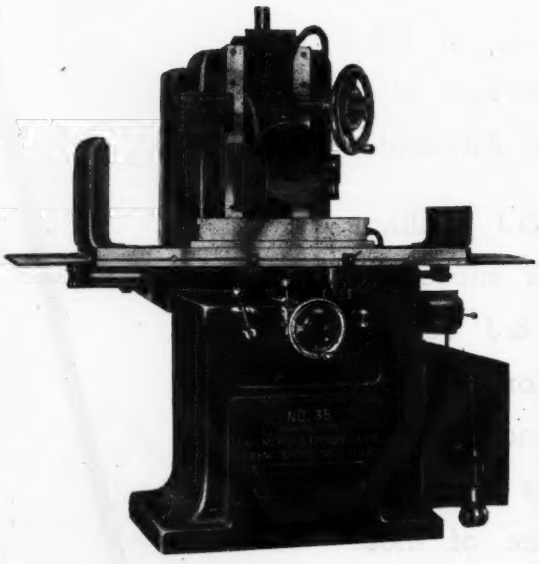
"THIS P&J ACHIEVEMENT IS YOUR KEY TO BETTER POST-WAR PRODUCTION"

WHETHER your postwar plans involve drastic changeovers, or a continued production much along the lines of current demands, your basic guides for peacetime efficiency are still to be found in recent production achievements and records. A case in point is the job illustrated at the left . . . an example of P&J efficiency in the high speed manufacture of a vital product on the P&J No. 6DRE Automatic.

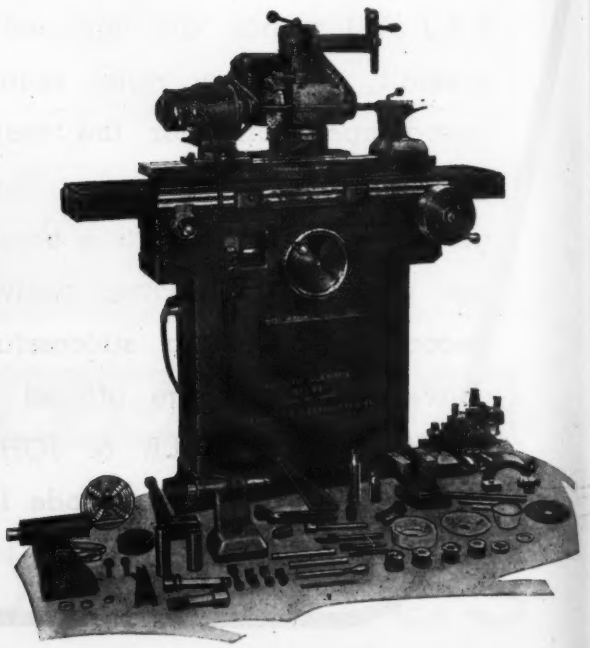
The set-up illustrated is typical of P&J Toolings on P&J Automatics for a number of successive roughing and finishing operations. P&J Tooling like this, and the well-known performance of P&J Automatics, are sufficient evidence of successfully fulfilling rigid requirements for high speed operations, for the maintenance of close limits of accuracy, for maximum output, for the greatest possible operating economy. These factors are your key to better postwar manufacturing. Recommendations to successfully complete your conversion plans are offered without obligation. . . . Write to POTTER & JOHNSTON MACHINE COMPANY, Pawtucket, Rhode Island.

YOU CAN COUNT ON *Grand Rapids* FOR PRECISION GRINDING!





For fast, accurate, dependable grinding – whether toolroom or production — choose GRAND RAPIDS GRINDERS and you can be sure of complete dependability and low-cost grinding performance! Shown here are three Grinders from our complete line. **Upper:** No. 55 Hydraulic Feed Surface Grinder with working table 12" x 36" and table speeds infinitely variable up to 125 FPM. **Center:** No. 35 Hydraulic Feed Surface Grinder with working table 8" x 24" and table speeds infinitely variable up to 115 FPM. Both these grinders feature heavy, rugged one-piece column and base casting, assuring sustained alignment; Vernier control of wheel movement, facilitating close-tolerance work; extra rigid spindle mount; two usable spindle speeds, thus reducing wheel costs. **Lower:** No. 60 Universal Cutter-Tool Grinder with cabinet base construction. Ball bearing table; hardened and ground ways; convenient controls; many other features. Write for bulletins, stating your requirements.



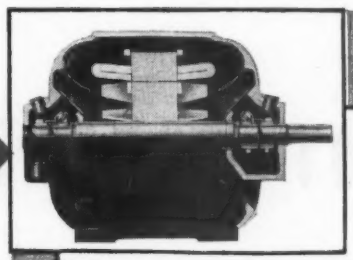
GALLMEYER & LIVINGSTON CO.

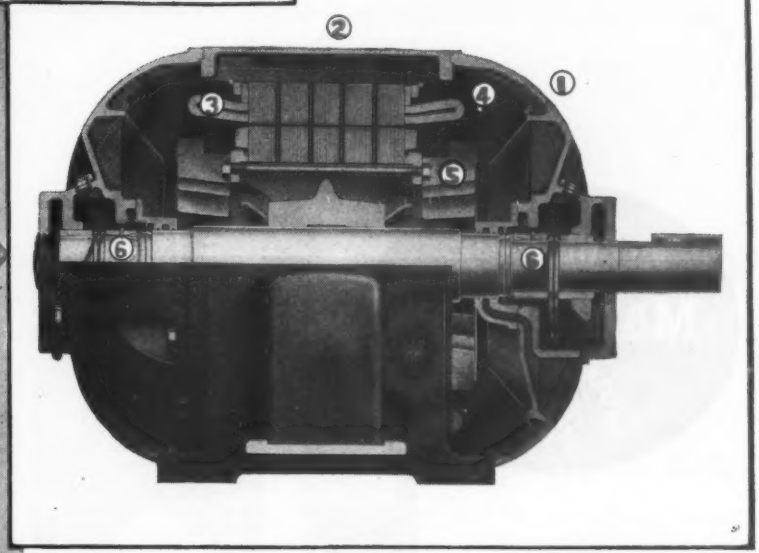
305 STRAIGHT AVENUE, S. W.
GRAND RAPIDS 4, MICHIGAN

SAME STRONG POINTS OF CONSTRUCTION

from 1 hp

to 2000 hp





Now all your drives — large and small — can have standard G-E Tri-Clad induction motors with the famous protective features that guard against PHYSICAL DAMAGE, ELECTRICAL BREAKDOWN, OPERATING WEAR AND TEAR.

Tri-Clad, in its wide range of types and sizes (recently increased to 2000 hp), is G.E.'s most widely used (integral-hp) motor. For complete details on ratings, characteristics, and dimensions, write for Bulletin GEA-3580. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

HERE'S TODAY'S WIDER RANGE OF STANDARD SIZES	
Tri-Clad Type K (Low starting current, normal starting torque)	1 hp to 2000 hp at 1800 rpm
Tri-Clad Type KG (High starting torque, low starting current)	5 hp to 200 hp at 1800 rpm
Tri-Clad Type KR (High starting torque, high slip)	Available to 100 hp in speeds required for high-slip flywheel drive (punch press, etc.)

1. Cast-iron frame and rigid, cast-iron end shields protect the motor from external blows and accidental abuse.
2. Completely enclosed upper portion of frame guards against entry of falling objects and dripping liquids; keeps chips and the like from vital motor parts.
3. Windings of Formex* wire—one of the toughest magnet wires yet developed—resist heat aging, heat shock, and abrasion.
4. End windings are coated with Glyptal* varnish, providing a tough, hard finish that withstands moisture, oil, and abrasion.
5. Low-velocity, double-end ventilating system keeps the motor running cool and prolongs insulation life. One-piece, cast-aluminum rotor (used on all but the largest sizes), with integrally cast fans, is practically indestructible.
6. Bearings have extra capacity to take heavy shaft loadings from any direction. Lubrication is convenient, its effectiveness well proved.

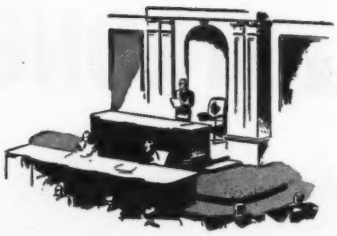
*Trade-mark reg. U. S. Pat. Off.

TRI CLAD MOTORS

Buy all the BONDS you can — and keep all you buy

720-205-8020

GENERAL ELECTRIC



THE STATE OF THE NATION TOMORRO IS

BULLARD

MAN-AU-TROL

MASTER OF THE MACHINE

RO IS IN YOUR STATE OF MIND TODAY

Two choices . . . and only two . . . now face you and others who make Industry's decisions.

Either you can sit back and *wait* to see what happens . . .

Or you can look ahead and *make* things happen.

If you choose the former, you *cause* to happen what you *hope* will not . . . idle machines with consequent troubles . . . continued government controls.

If you choose the latter, you *show government* that you want to run your own business and can run it efficiently . . . you *show labor* that you have confidence in its willingness to work with you for the common good . . . you *show the people* that busy machines are the foundation of America's high standard of living.

When machines produce more, unit costs go down . . . while wages are maintained on a high level. More buying power generates the greater demand that increases production even more.

What is your choice? It *must* be to make your machines produce more . . . to lower unit production costs . . . to keep employment at high levels. And because that must be your choice, you will want to investigate the Bullard *Man-Au-Trol* principle of Automaticity . . . which, for the first time, makes an automatic machine even more versatile than a manually-operated machine.

HOW THE BULLARD MAN-AU-TROL VERTICAL TURRET LATHE LOWERS UNIT PRODUCTION COSTS

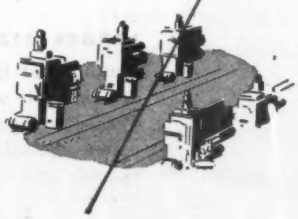
1. LIGHTENS LABOR'S LOAD: The operator goes once through the machining cycle manually, setting the best production method into an automatic cycle. Then he merely loads, supervises and unloads while the Man-Au-Trol does the work.

2. MAKES AUTOMATICITY VERSATILE: It automatically machines any and all work which the Vertical Turret Lathe can handle when operated manually. Is instantly convertible for manual operation on the same piece or an entirely different piece without affecting the automatic cycle for which it is set.

3. SAVES SET-UP TIME: Unlike most other automatic machines, its set-up time from one class of work to another is only slightly more than for a manually-operated machine.

4. REDUCES SALVAGE COSTS: It machines day after day with a degree of accuracy impossible under manual operation because it eliminates human and cumulative error.

For additional facts about the way the new Bullard Man-Au-Trol Vertical Turret Lathes minimize tool investment, reduce machining time and other manufacturing costs, write for Bulletin MAV-G-1. The Bullard Company, Bridgeport 2, Conn.



BULLARD CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

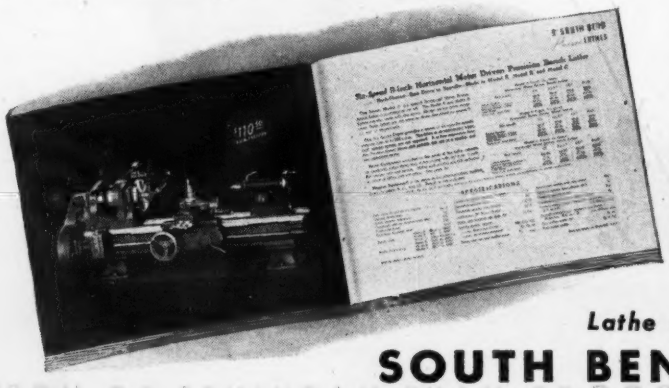
Get This New Catalog

MAILED FREE ON REQUEST

Write For It Today!

Designed and built for close precision work, the South Bend 9″ Precision Lathe is the ideal lathe for the production of small, accurate parts, for toolroom work, and for use wherever exactness is essential in the working of metal, plastics, fibre or other machinable materials.

Catalog 9-G illustrates in color all models of South Bend 9″ Precision Lathes, lists capacities, speeds, feeds and weights, and shows available attachments and accessories. Thirty-six pages, size 11″ x 8½″. Mailed on request, without obligation. Write today.



LARGER SIZES OF SOUTH BEND LATHES

South Bend Engine Lathes and Toolroom Lathes are available with 9″, 10″, 13″, 14½″, and 16″ swings. Precision Turret Lathes are made with ½″ and 1″ collet capacities. Information supplied on request. Specify size of lathe in which you are interested.

Lathe Builders Since 1906

SOUTH BEND LATHE WORKS

424 EAST MADISON ST. • SOUTH BEND 22, INDIANA

The Standard Man

Alert to Your Present Problems

HIS business is to help you meet *today's* production problems with efficiency and economy.

Usually he can select from a stock of thousands of Standard Shield Brand Tools the drill, reamer, tap, die, or milling cutter that will do the best job for you.

If your problem is unusual or difficult, he brings you the benefit of this Company's 64 years of experience in helping solve tough metal cutting problems for America's most exacting users in the Aviation, Automotive, Farm Implement, Transportation and Electrical industries.

The Standard Man, whether factory or mill supply distributor representative is a good man to know, because he knows his business. His service and suggestions are yours without obligation. For prompt attention to your present requirements, call or write

Red Shield Brand
TWIST DRILLS
REAMERS
MILLING CUTTERS
TAPS · DIES
SPECIAL TOOLS

THE STANDARD TOOL CO.

CLEVELAND

NEW YORK STORE
94 READE STREET

DETROIT STORE
2457 WOODWARD AVE.

CHICAGO STORE
552 W. WASHINGTON BLVD.

STANDARDIZE

How Far ? ?

NO one argues about Standardization of methods, procedures, and products as a means to reduce costs, and thus maintain a competitive position with fair profit margins.

Many makers have found added profits in Standardizing on one make of metal cutting tools—that is, Standard Shield Brand Drills, Reamers, Taps, Dies, Milling Cutters, and Special Tools.

These tools are manufactured in one plant, under the same laboratory control of materials, the same skilled supervision, the same rigid standard of inspection.

Result, all of these types of Shield Brand Tools are uniform in economical performance. Workmen like them—they help your program to Standardize and thus reduce costs. Why not try them?

Leading Industrial Supply Distributors from coast to coast gladly furnish your requirements for Standard Shield Brand Drills, Reamers, Taps, Dies, Milling Cutters and Special Tools.

THE STANDARD TOOL CO.

CLEVELAND

NEW YORK STORE
94 READE STREET

DETROIT STORE
2457 WOODWARD AVE.

CHICAGO STORE
552 W. WASHINGTON BLVD.

STANDARDIZE

How Far ? ?

NO one argues about Standardization of methods, procedures, and products as a means to reduce costs, and thus maintain a competitive position with fair profit margins.

Many makers have found added profits in Standardizing on one make of metal cutting tools—that is, Standard Shield Brand Drills, Reamers, Taps, Dies, Milling Cutters, and Special Tools.

These tools are manufactured in one plant, under the same laboratory control of materials, the same skilled supervision, the same rigid standard of inspection.

Result, all of these types of Shield Brand Tools are uniform in economical performance. Workmen like them—they help your program to Standardize and thus reduce costs. Why not try them?

Leading Industrial Supply Distributors from coast to coast gladly furnish your requirements for Standard Shield Brand Drills, Reamers, Taps, Dies, Milling Cutters and Special Tools.

THE STANDARD TOOL CO.

CLEVELAND

NEW YORK STORE
94 READE STREET

DETROIT STORE
2457 WOODWARD AVE.

CHICAGO STORE
552 W. WASHINGTON BLVD.

THEY GAVE THEIR PROBLEM THE HOT SEAT

5400 per hour WITH TOCCO

TO improve engine performance and cut costs, this manufacturer altered the design of his tappet. A steel push rod seat, brazed to the tappet cylinder, was the basic idea. The problem was to harden the seat without scale, without distortion of the cylinder and without affecting the braze... and to do this *at low cost*.

A TOCCO Induction Heating machine with special fixture solved the problem with these results:

TOCCO electrical induction heats the seat only to a uniform depth. TOCCO's integral quench then cools the area, hardening it to 60 R.C. This quick, localized treatment avoids scaling and distortion, and does not disturb the nearby braze. The quality of the result is attested by millions of these tappets now in service.

And as for *low cost:* Two wheel fixtures keep the tappets turning into the inductor and quench. Operators simply load the wheels. The tappets drop out at the bottom at a *cost-cutting rate of 5400 per hour*.

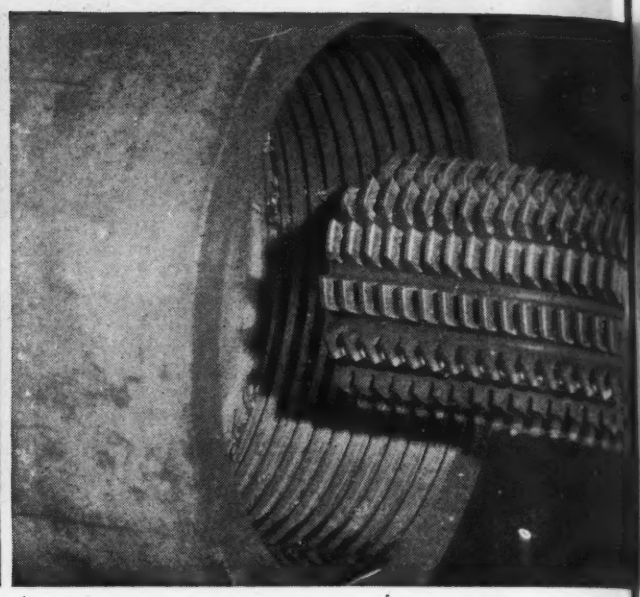
How about *your* problem? The TOCCO Engineer nearby and the TOCCO Development Laboratory are at your service. Write for free copy of "Results with TOCCO".

THE OHIO CRANKSHAFT COMPANY • Cleveland 1, Ohio

TOCCO

INDUCTION
HARDENING, BRAZING
ANNEALING, HEATING

Rotary MILLING



THIS CROSS MACHINE sharply reduces the cost of machining cylindrical, conical or flanged work-pieces. Equipped with special work-holding fixture and a multi-tooth form cutter, it mills this spherical contour with unerring accuracy in one-twelfth of the time previously required. Its full automatic cycle and push-button control permit unskilled operators to achieve top accuracy and production. In addition to rotary milling, the machine may also be used for a wide variety of internal or external thread-milling operations.

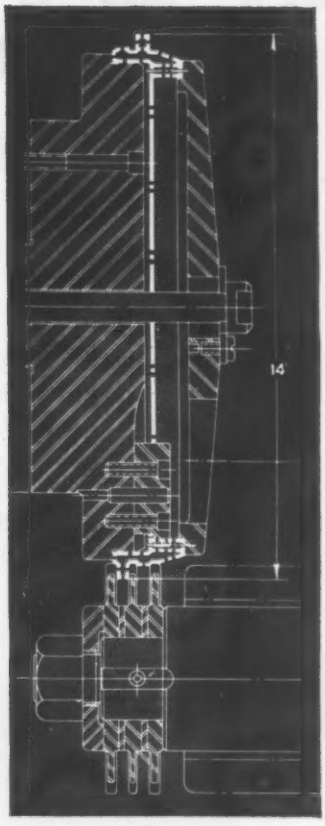
If you have a production problem in milling, boring, turning, drilling, tapping, reaming, grinding or honing, solve it with a Cross Machine, specially designed and built to suit your needs. THE CROSS COMPANY, Detroit 7, Michigan, Dept. 183.

S-26

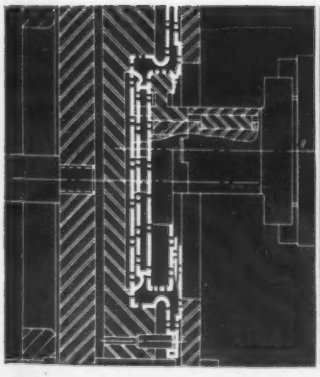
CROSS

New York • Chicago • DETROIT • Cleveland • Cincinnati

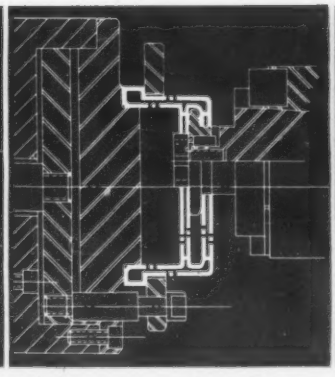
AND THREADING



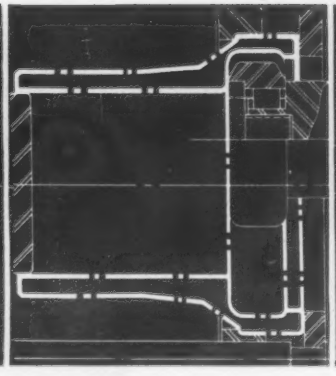
External operations with interrupted cuts are finished to close tolerances with the Cross Rotary Miller.



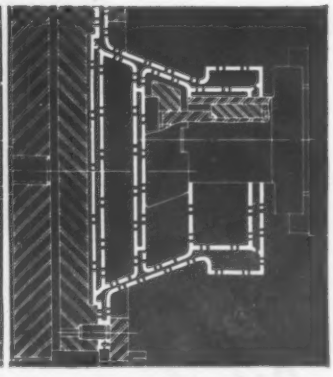
Rotary milling is an ideal method for handling many difficult operations on aircraft parts.



Multiple edge cutting tools with an enveloping cutting action satisfy the most exacting demands for fine finish.



Deep internal contours can be finished in one operation with the Cross Machine.



Irregular contours are processed in the usual way without special attachments or tooling.

SPECIAL MACHINES

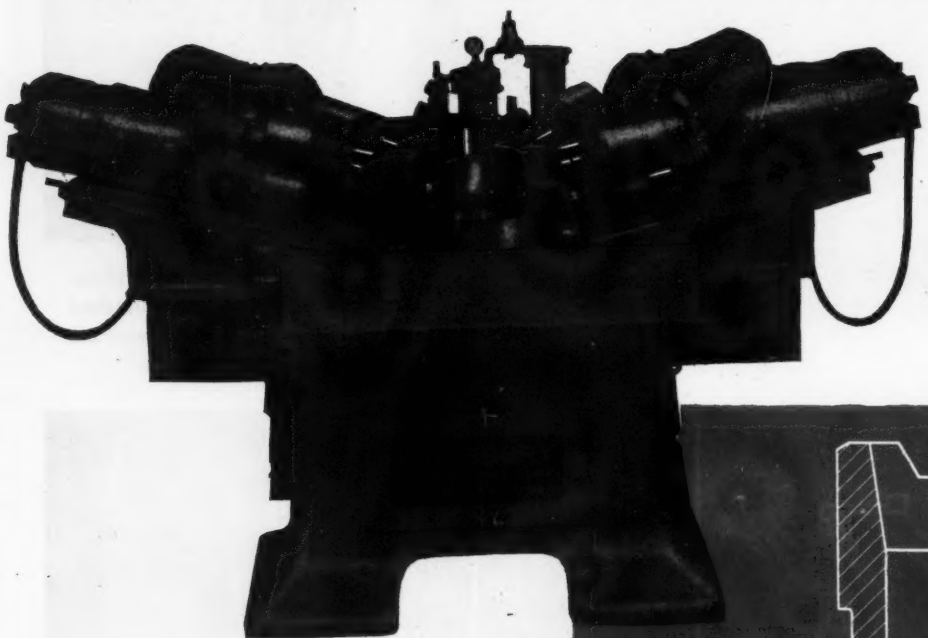
for automatically performing any one or a combination of metal cutting operations

TURNING · MILLING · DRILLING · BORING · REAMING · TAPPING · GRINDING

FLEXIMATIC *by Kingsbury*

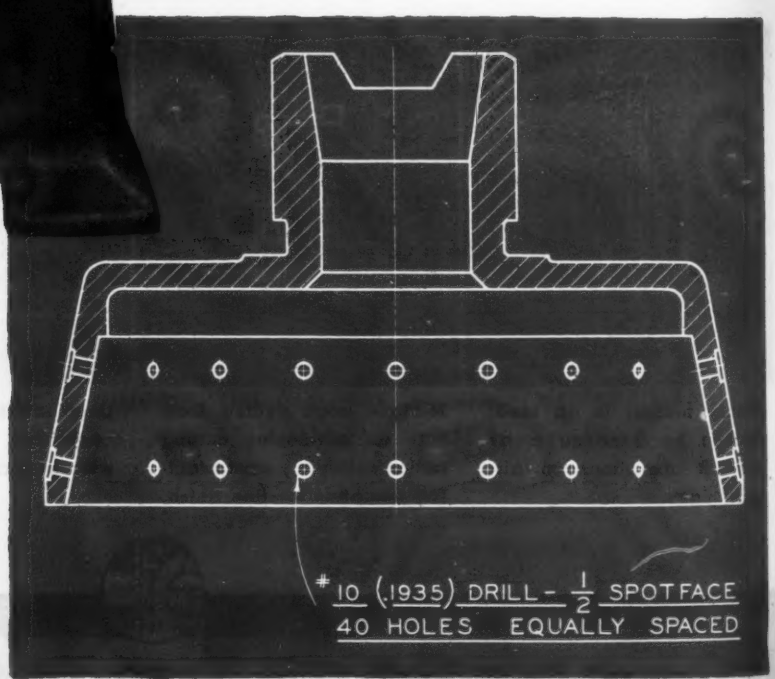
. . . DRILLS AND SPOTFACES 40 HOLES IN ONE CHUCKING!

Here's another example of how Kingsbury FLEXIMATICS can combine and simplify operations, make mass-production speeds possible on even the most intricate jobs, cut machining costs appreciably. Job shown here requires drilling and spotfacing of 40 holes in Brake Shoes. Using the 8-spindle Fleximatic — designed from standard Fleximatic units mounted on a standard base—the operator merely clamps work in fixture and trips machine. All operations are then performed automatically, and machine automatically stops. Fleximatic units can be changed, moved around and mounted in any combination on the base to meet the machining requirements of many different parts. Investigate it for your requirements!



IDEAL

for drilling, tapping, milling, reaming, boring, spotfacing, counterboring, etc., in any sequence, in any combination.



Write today for illustrated Bulletin showing a number of different set-ups.

★

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U.S.A.

A Modern Production Machine

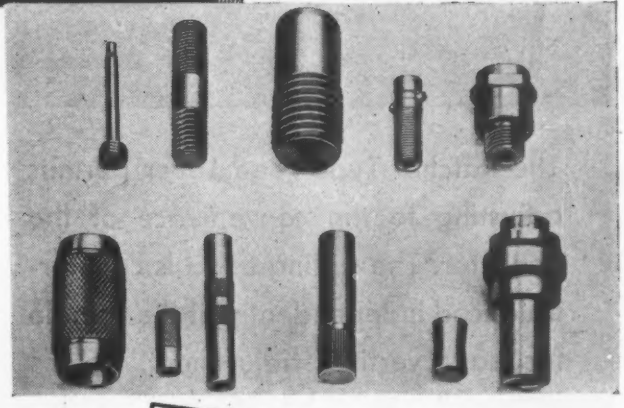
Send for this NEW BOOK

New **machine for mass production on high precision parts**

• If you make small parts to aircraft and automotive standards of accuracy, you'll want the complete data on National Acme's new Triple-Roll Hydraulic Thread and Form Rolling Machine.

A money-saver for threading, knurling, serrating or burnishing—hand or automatic feed.

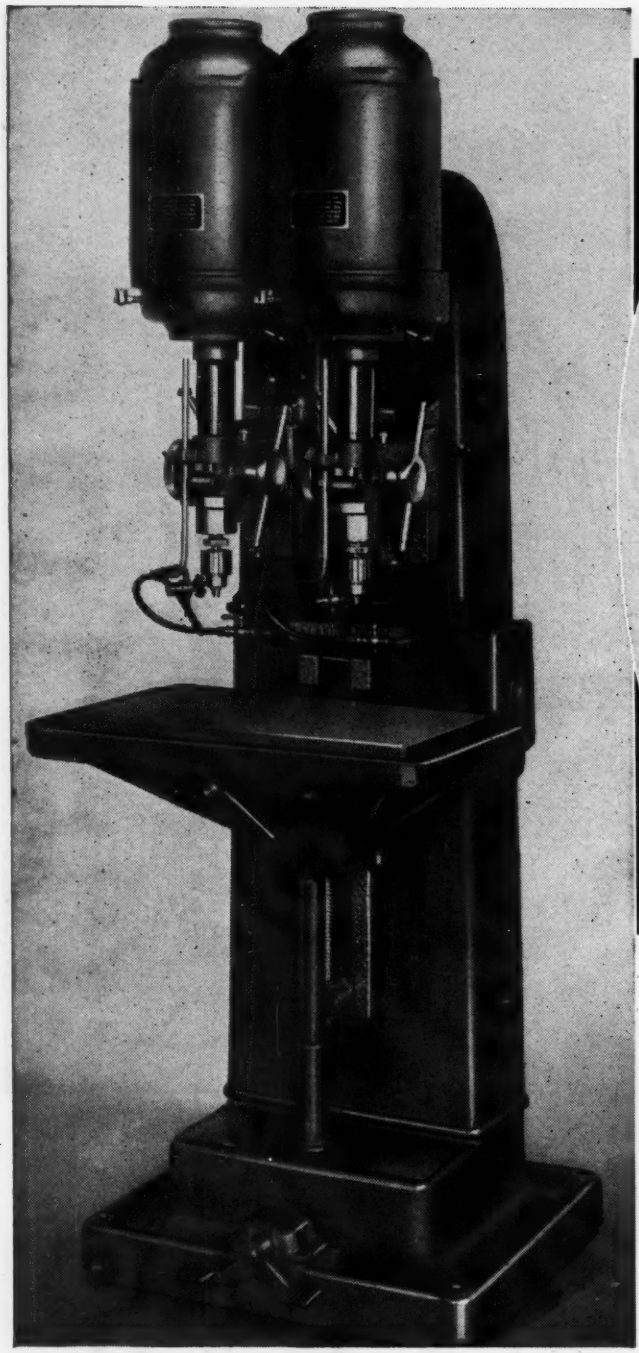
Write us for new catalog TR-45.



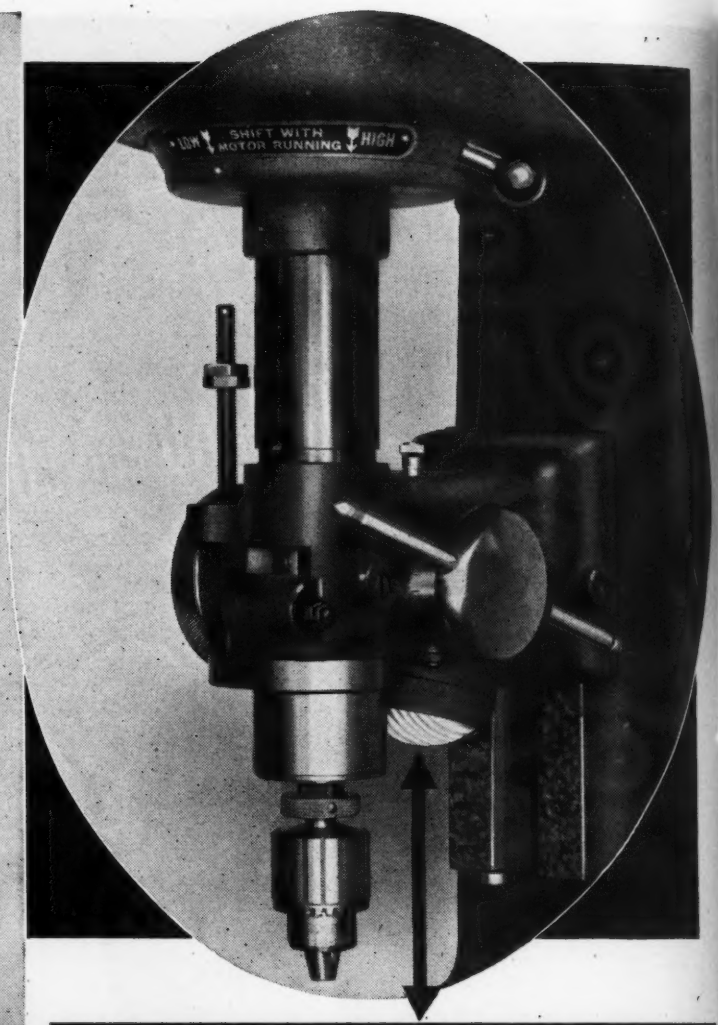
The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing



The Ratchet Type Feed Lever permits adjusting to the convenience of the operator. The sliding head is counterbalanced independently of the spindle for easy vertical adjustment.



LIGHTS THE TABLE *without glare*

A Low Voltage Mazda Lamp with ground glass lens and chromium plated reflector is built into the under side of each sliding head of

LELAND-GIFFORD No. 1 LMS DRILLING MACHINES . . . . . .

LELAND GIFFORD

WORCESTER 5, MASSACHUSETTS, U.S.A.

Tools
by UNION
are "THE TOOLS YOU
BUY AGAIN."
Union Twist Drill Co., Athol, Mass.
UNION ★ BUTTERFIELD ★ CARD Divisions of the Union Twist Drill Company

for profitable peacetime production choose
Butterfields!
BUTTERFIELD DIVISION
Derby Line, Vt.
Rock Island, Que.
STORES: New York, 61 Reade St. —Chicago, 11 So. Clinton St.— Cleveland, Hal. W. Reynolds, 3346 Superior Ave.—Detroit, 5527 Woodward Ave.—Los Angeles, 524 E. Fourth St.—Toronto, 137 Wellington St., West—Montreal, 111 St. Paul St., West—Winnipeg, David Philip Agencies, Ltd., 212 Bannatyne Ave.—Vancouver, 327 Shelly Bldg. Agents for Great Britain: Charles Churchill & Co., Ltd., 27-34 Walnut Tree Walk, Kennington, London, S.E. 11, England. Branches at Birmingham, Manchester, Glasgow, Newcastle-on-Tyne and Bristol.

CARD

free-cutting spiral-pointed

HAND TAPS

Card Spiral Pointed Hand Taps are designed for tapping through holes or blind holes when drilled deeply enough. Correctly used, these Taps produce a smooth, free-cutting action which results in excellent, accurate threads.

FORCING THE CHIPS *ahead* OF THE TAP

Above is a detailed view of chip-action produced by Card Spiral Pointed Hand Taps. Long, curling chips are forced ahead of the Tap, avoiding clogging, increasing strength of Tap, reducing breakage.

S. W. CARD MFG. CO.

Mansfield Mass.

STORES:

New York: 61 Reade St.
Chicago: 11 So. Clinton St.
Detroit: 5527 Woodward Ave.
San Francisco: 121 Second St.
Los Angeles: 524 E. Fourth St.
Seattle: 568 First Ave., South

of the Union Twist Drill Co.

ANOTHER EXCLUSIVE HYPRO FEATURE

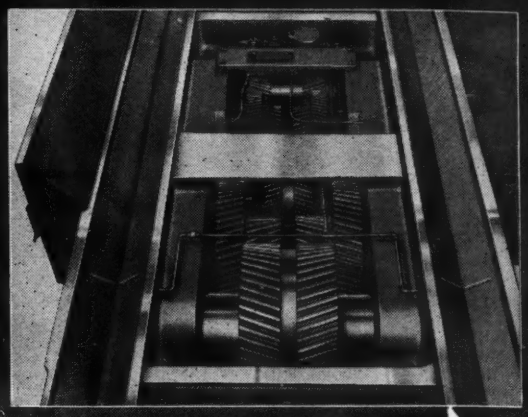
Complete Herringbone Twin Gear Table Drive

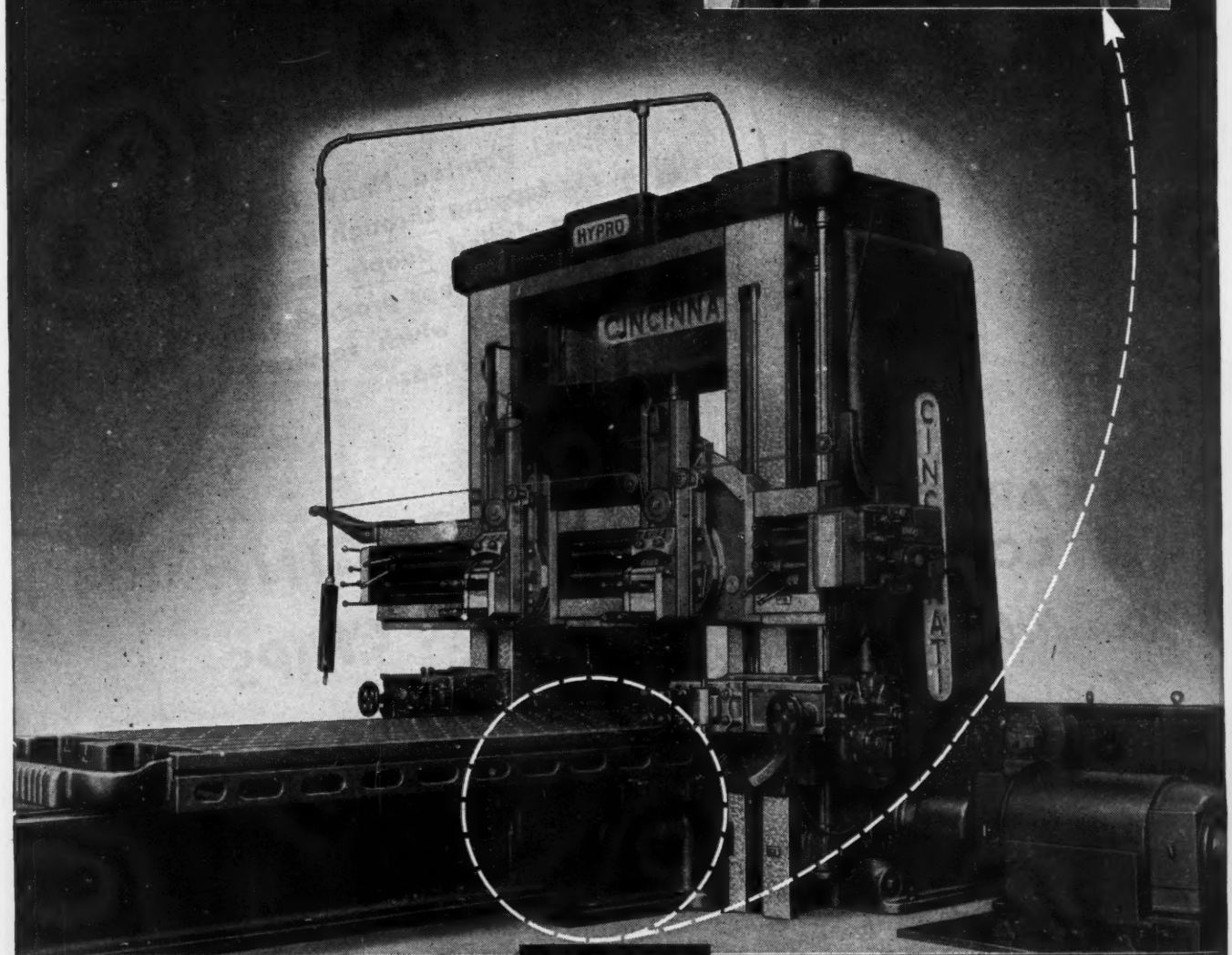
In no other planer will you find the complete steel herringbone twin gear table drive.

The twin gear train, including the bull wheel and rack, is of the herringbone type. This construction gives a smooth, continuous and even flow of power through greater tooth surface and eliminates side thrust.

There is no shock when the load is transferred from tooth to tooth, eliminating practically all wear. The gears work silently and without vibration on their large diameter shafts which are hardened full length and ground at the journals. All gears and pinions are made of steel and flame hardened.

This is one of those exclusive features that make the Cincinnati Hypro a buyer's choice.

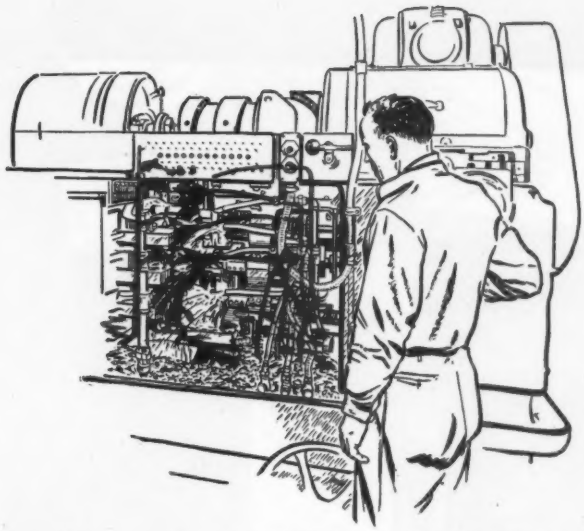




THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO



We Make No Other Claim Than This . . . "PERFECTED LUBEWELL" CUTTING COMPOUND WILL OUT-PERFORM ANY CUTTING OIL OR SOLUBLE EMULSION REGARDLESS OF THE MACHINE TOOL OR TYPE OF WORK BEING DONE

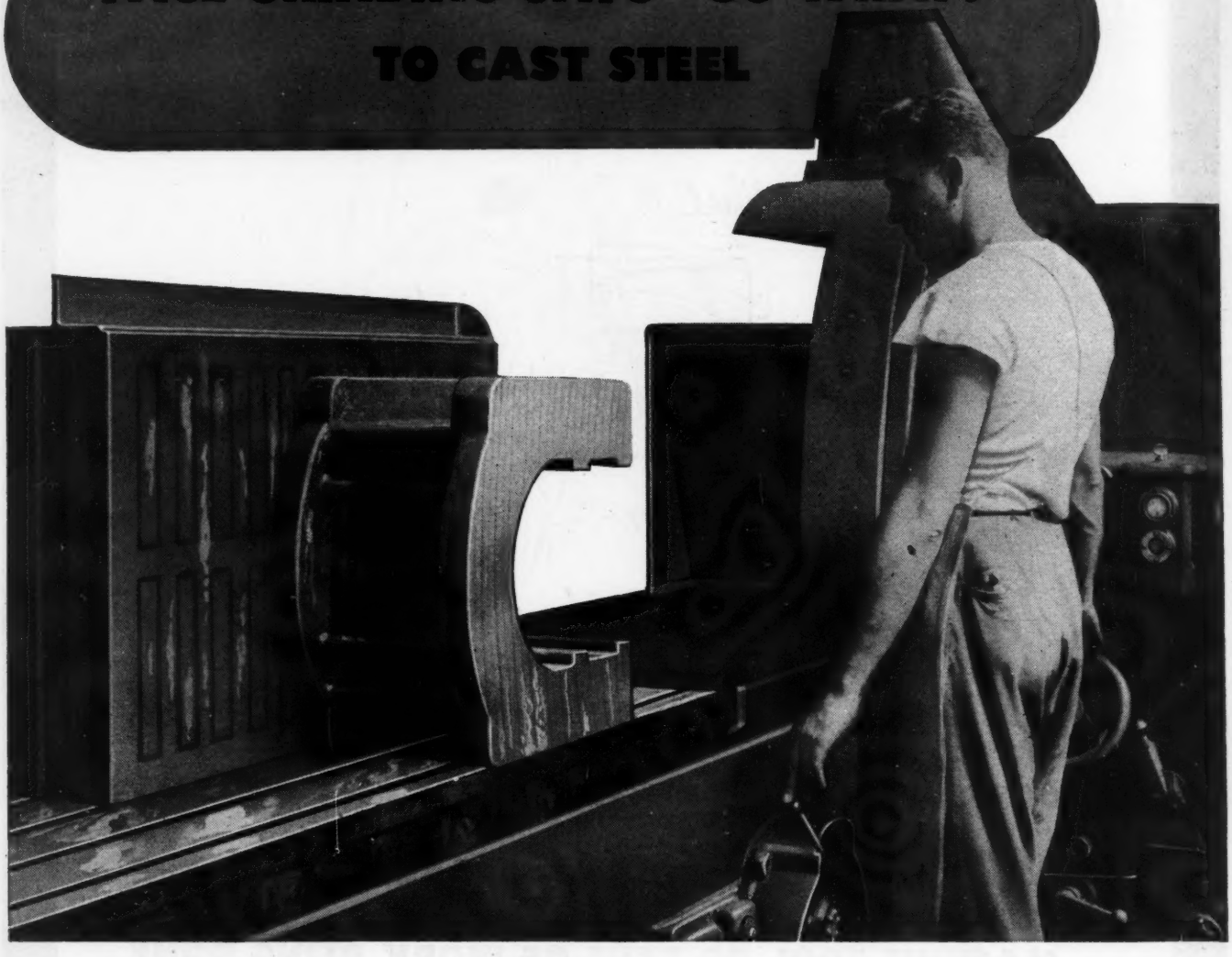
To prove this statement, G. Whitfield Richards will ship you any quantity of "Perfected Lubewell" and if you find that it does not: 1. increase tool life up to 50%; 2. increase production speed of the machine up to 25%; 3. give a superior finish and hold to closer tolerances; 4. lower cutting lubricant cost as much as 40%... you may tear up the bill. "Perfected Lubewell" is known from coast to coast as the one cutting compound for all machining operations, costing from 3 to 9 cents per gallon in the machine.

G. WHITFIELD RICHARDS

PIONEERS OF *Water Soluble Cutting and Drawing Lubricants*

1736 CARLTON STREET · PHILADELPHIA 2, PA.

FACE GRINDING SAYS "SO WHAT?" TO CAST STEEL



Most locomotive parts like this main driving box are being made of cast steel. But cast steel or cast iron makes no difference to the Diamond Face Grinder. For example, this cast steel piece was faced 2 sides in 28 minutes floor-to-floor, removing a total of 9/16" stock.

No special fixtures were used, only a magnetic chuck. And a better finish than was formerly obtained was produced at no additional cost. Had the piece been designed for face grinding much less time would have been required.

Write for new Bulletin 44-G at once. See for yourself how many types of work you can face better and faster on a Diamond Face Grinder.

MAIL TODAY FOR NEW FOLDER

Diamond Machine Company of Philadelphia
2435 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Please send me promptly your Bulletin 44-G which shows how to speed-up production with he Diamond Face Grinder.

Name_____ Title_____

Company_____

Address_____ State_____

City_____

"THE DIAMOND D THAT CUTS YOUR COSTS"

DIAMOND
MACHINE COMPANY
OF PHILADELPHIA

Subsidiary of American Engineering Company, manufacturers of A. Taylor and Perfect

GRINDS *TWICE AS FAST*

THIS foundry was using flexible shaft grinders for truck blocks. Speed was only 3500 r.p.m. Maintenance costs were high.

The Rotor Application Engineer suggested light, powerful Air grinders—8500 r.p.m. for 4″ x 1″ x ⅜″ wheels and 6000 r.p.m. for 6″ x 1″ x ⅜″ wheels. Rotor D-77 and D-100 Powerplus Grinders were installed. Results, according to the Master Mechanic:

100% increase in grinding rate.
Less fatigue for operators.
Lower maintenance. No more flexible shaft breakages from bending around sharp corners.

Feel free to call the Rotor Application Engineer anytime to suggest improvements in *your* portable tool operations.

Yours for faster grinding,
AIR O'TOOL

AIR

THE ROTOR TOOL CO.
CLEVELAND, OHIO
UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

HIGH CYCLE

then he said to himself:

"We want a 50-50 Peace on Earth"

MANY people wonder why Japan stuck it out alone for so long. The secret is now exposed by Hirohito's Lord Keeper of the Privy Seal, Koichi Kido, in these prize words:

> "It wasn't a question of whether we could win. I hoped we could fight long enough so that the U. S. would be satisfied with a fifty-fifty peace—*leaving us what we won.*"

A burglar could as well make a "50-50" peace with the police by taking the swag *he won* and leaving the safe.

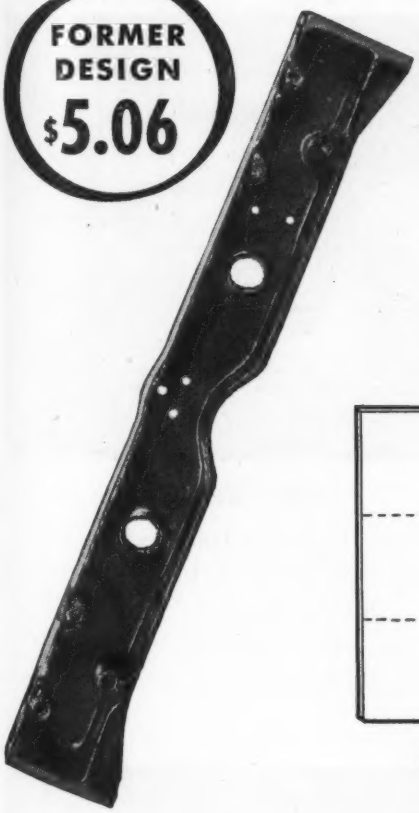
A 50-50 approach in building nations, as in building a business, is but a compromise . . . a temporary expedient. *Total results* require total intelligence, applied all the way, along proven lines.

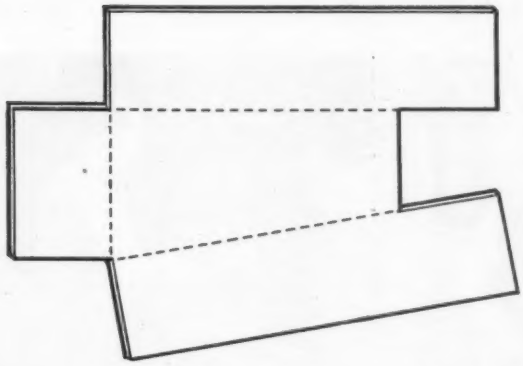
"50-50"... *he hoped for*

LOOK, KIDO, how manufacturers contribute to *total peace* between themselves and their customers:

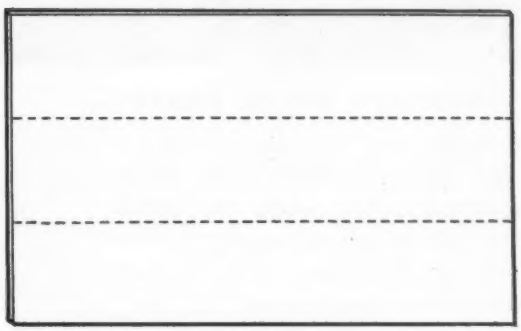
No compromise here..They save $2.74

FORMER DESIGN $5.06

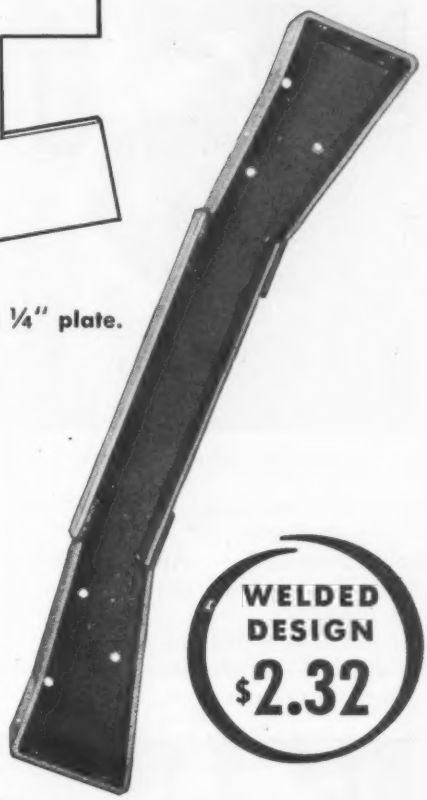




Stamp or cut two of these parts from ¼" plate.



Stamp this piece from ¼" plate.



WELDED DESIGN $2.32

Jig up and weld . . . Saves $2.74. Cuts weight from 33 lbs. to 23 lbs.

THIS frame member illustrates the simplicity of changeover to welded design . . . and shows *how it pays*. Here it cuts costs 54% and produces a stronger, more rigid and lighter product . . . one that can be constantly improved easily and quickly.

Here is the key to a 100% solution to many of your problems of today. The Lincoln Engineer will gladly help you get the results *you* want. Studies in Machine Design free on request. Ask for them on your business letterhead.

THE LINCOLN ELECTRIC COMPANY • Dept. J-1 • Cleveland 1, Ohio

America's greatest natural **recourse**

ARC WELDING

An All-Purpose SURFACE

GRINDING by HANCHETT

FAST • ACCURATE • ADAPTABLE

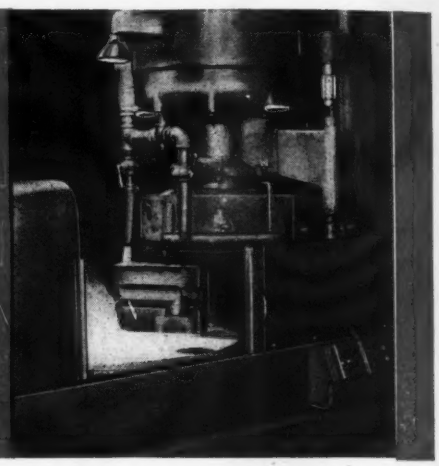
Check the examples below—and you'll see why the Hanchett No. 36 is considered standard equipment in a wide range of industries! Because of its versatility and capacity, the No. 36 handles the bulk of surface grinding work in smaller shops, and is kept continuously at work in large plants on production jobs or in the toolroom.

AUTOMOTIVE PARTS

Part—Internal Gear Clutch Plate, SAE-4135 steel, 6″ diameter.
Stock Removal — Approximately .0025″ each side, to reduce to a micro-finish.
Tolerances—+ .000, — .001.
Production—Approximately 100 finished pieces per hour.

AIRCRAFT ENGINE PARTS

Grinding top of cylinder ends to size. Must be ground square and to tolerance at both ends, since this is the first operation, and the preciseness of subsequent machining depends on accuracy here.



DIES AND JIGS

Part—Upsetting Die Block.
Stock Removal—1/16″ Total. (.064 per min.)
Tolerances—±.0005″.
Production—Small Lots.

DIESEL ENGINE PARTS

Part—Cylinders Head Cover Base.
Stock Removal—.100″.
Tolerances—±.010″.
Production—18 Pieces per hour (.0555 per piece).

SMALL CUTTING TOOLS

Grinding single point, carbide tipped tools, grouped on a rotary magnetic chuck. The versatile Hanchett 36 handles the job easily with greatly increased production over previous methods.

ROUGH CASTINGS

Part—Upper frame for Belt Grinder.
Stock Removal—¼″ to ⅜″, Both Sides.
Tolerances—±.003″ on overall. Scale measurement on boss.
Production—108 finished pieces per hour.

HANCHETT GRINDERS — ENGINEERED FOR YOUR JOB

GRINDER ... *In Every Way*

The
HANCHETT NO.36
VERTICAL SPINDLE
ROTARY TABLE

Check these Features

- One-Piece cast semi-steel column assures Rigidity for the most precise grinding operations.
- Patented Head Design allows grinding Head to be tilted in Any Direction.
- Table Speeds are Variable, ranging from 6 to 36 R.P.M.
- Capacity-Work up to 40″ diameter and 14″ High.
- Automatic feeds and stops located on Push Button control panel making one centralized unit.

HANCHETT ENGINEERING SERVICE

Hanchett Engineers will be glad to study your drawings and requirements, and make recommendations on the proper method and machine for your job, with no obligation on your part.

And remember—since Hanchett makes *all* types of surface grinders, you are assured of unbiased advice on your grinding problems. Feel free to consult the experts of the industry.

SEE YOUR NEAREST HANCHETT DEALER OR WRITE FOR CATALOG 144-LML

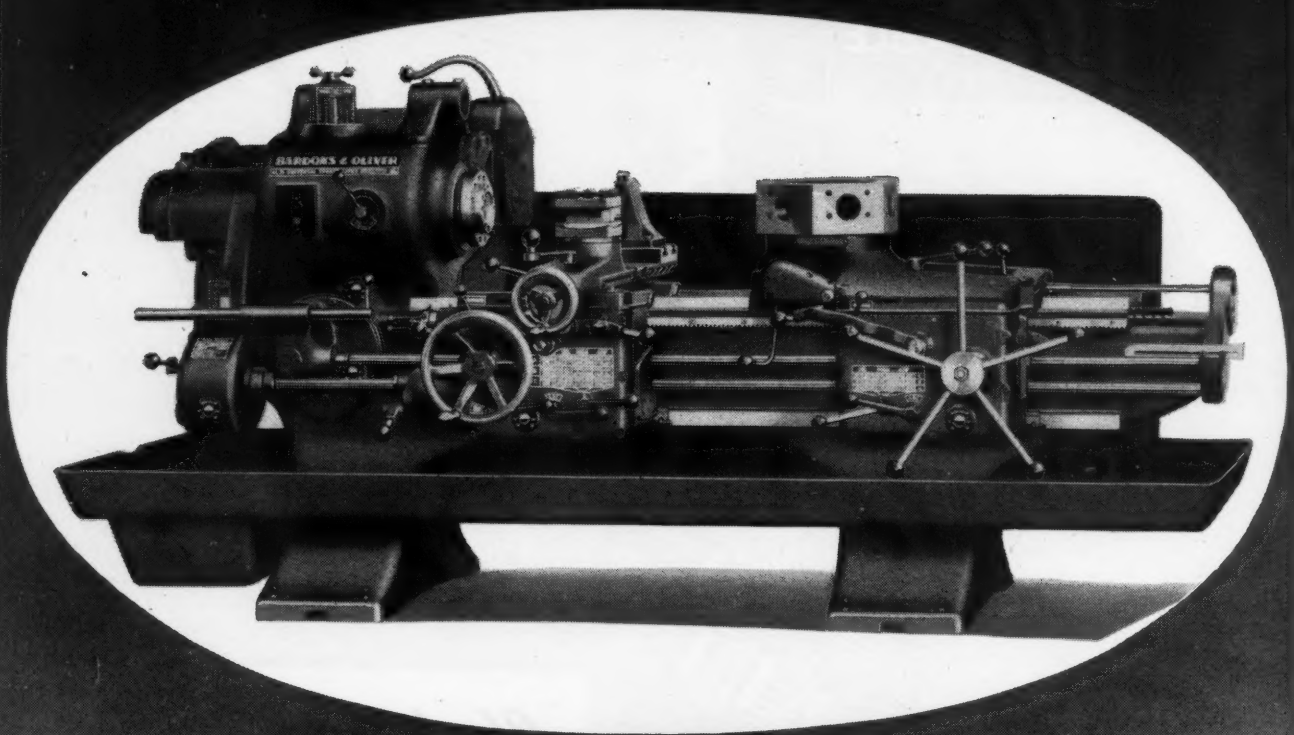
HANCHETT GRINDERS — BIG RAPIDS MICHIGAN

IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

HANCHETT MANUFACTURING CO.
BIG RAPIDS, MICHIGAN U.S.A.

HANCHETT HERMETI-COIL MAGNETIC CHUCKS

No. 21 *Saddle Type* TURRET LATHE



High Standards

OF WORKMANSHIP AND PERFORMANCE

MAKE THIS BARDONS & OLIVER TURRET LATHE

AN OUTSTANDING INVESTMENT . . . .

BARDONS & OLIVER, INC.

1133 WEST 9TH STREET • CLEVELAND 13, OHIO

LOWER COSTS for BETTER PRODUCTS

with Acme-Gridley CHUCKERS

Let's look ahead six months or a year, or two years—to the time when war production is finished.

Nation-wide plant capacity will be greater than ever before. We can make more goods than reasonable demand can absorb.

With material and labor costs about the same in all plants, isn't it logical to look upon *time of production* as the one controllable factor in setting up competitive prices?

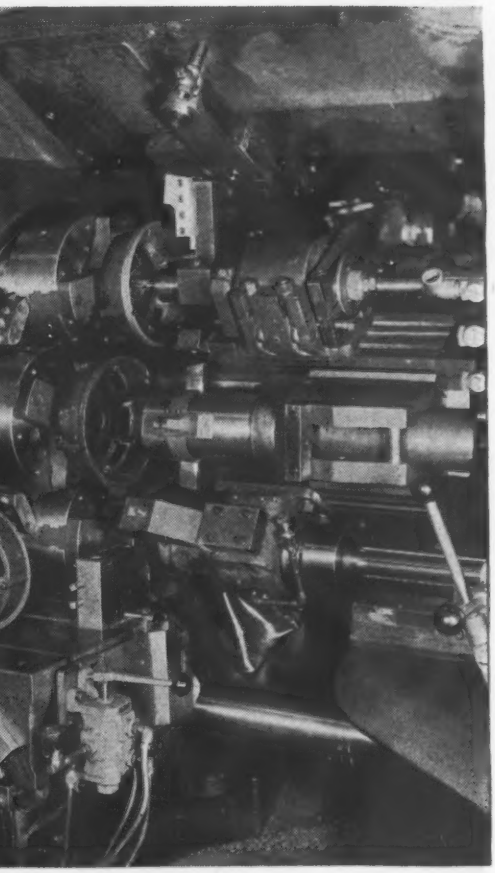
Here is a typical example:

The part is a cast iron motor bracket, 10½" in diameter. There are many ways to do the 14 operations necessary to finish this part.

On a 12" Six-Spindle Acme-Gridley Chucking Automatic, using carbide-tipped tools, machine time for all 14 operations was cut to *less than a minute.*

That's the way Acme-Gridley Chuckers can help you achieve lower competitive selling prices—by producing your precision parts in less time.

Acme-Gridley Chuckers are universal machines—not special one-purpose tools.



Booklet "How Costs Were Cut on 25 Chucking Jobs" shows their broad-range adaptability. Send for your copy.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

COLLETS AND PUSHERS

The design, materials and methods of processing GENUINE Acme-Gridley Collets and Pushers are vital to continuous low-cost performance on your Multiple Spindle Automatics.

Bulletin CP-45

TAPPING OR THREADING

Acme XL Threading Machines Can Do Either!

HILL ACME TOOLS FOR INDUSTRY

THESE BRONZE NUTS are tapped on an Acme XL 3" single spindle Threading machine at the Duff-Norton Manufacturing Company, Pittsburgh, Pa., manufacturers of lifting jacks. The tap is held by an adaptor which can be quickly and easily slipped over the regular Acme Tangent Die Head. The jack screws used in conjunction with these nuts are, of course, threaded on the same Acme XL Threading machine. For more information concerning the versatility of Acme XL Threading machines, write for bulletin XL-9!

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • 4535 St. Clair Ave. Cleveland 14, Ohio

ESTABLISHED 1882

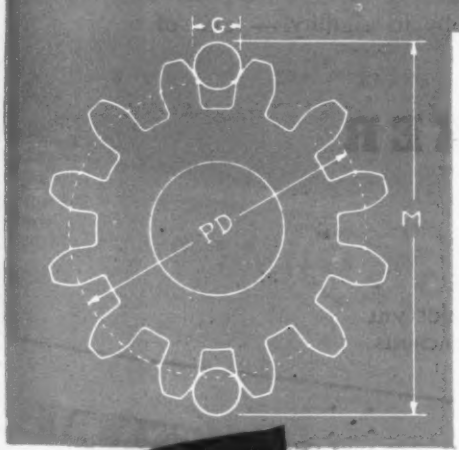
FORGING · THREADING · TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" HYDRAULIC SURFACE GRINDERS "CANTON" ALLIGATOR SHEARS AND PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES AND SHEAR BLADES

Van Keuren

simplified GEAR MEASURING SYSTEM

Set No. 28 Ex. Gear Measuring Wires

...provides GREATER ACCURACY... and SIMPLIFIED CALCULATIONS

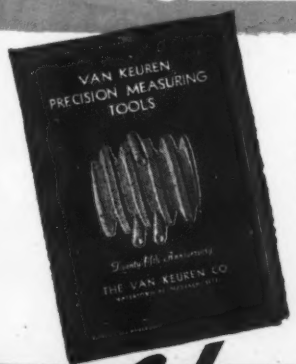


Simple! . . . The only calculation required is one of simple division.

Reliable! . . . The system is based on formulas approved by the American Gear Manufacturers Association.

Accurate! . . . Van Keuren Gear Measuring Wires are accurate to within 25 millionths of an inch for roundness and exact size.

Van Keuren gear measuring tables give the measurements (M) over the wires (G) for 1 diametral pitch gears of correct pitch diameter (PD). The only calculation required is to divide the measurement for 1 diametral pitch by the diametral pitch of the gear being measured. The tables are complete for gears from 5 to 171 teeth and for pressure angles of 14-1/2°, 17-1/2°, 20°, 25° and 30°. The tables provide for measuring external, internal and helical gears. They are far more accurate than anything previously available and no interpolations are required.



ULTIMATE ACCURACY

Our Catalog No. 33 is a manual of precision measuring systems, giving complete tables and simplified formulas for measuring all standard threads, splines, gears, and worms. Send for this valuable handbook.

THE Van Keuren CO., 178 WALTHAM ST., WATERTOWN, MASS.

25th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles

Announcing the

KEARNEY & TRECKER

MILWAUKEE

Precision Milling and Boring Machine

No. 3 MODEL T

Precision Milling plus Precision Boring — performed in one setting of the workpiece — results in greater accuracy in the finished product. That is the contribution this machine offers to economical production of parts requiring precision milling and boring operations.

Developed by Kearney & Trecker engineers to provide a faster and more accurate method of highly precise milling and boring in one setup, the Kearney & Trecker Precision Milling and Boring Machine embodies these basic features:

- Precise machine alignment and measuring devices to assure highly accurate results.
- A No. 50 National Standard spindle nose that accommodates modern milling and boring tools.
- Centralized boring head controls, dual table controls and a swivel control pendant provide for easy and rapid operation.
- Both right and left hand spindle rotation permitting the use of right or left hand milling cutters.
- A thread cutting feature that permits both boring and thread cutting operations in a single setup.
- A wide range of speeds and feeds are available for the efficient use of modern cutting tools on a wide variety of operations.

Again Kearney & Trecker engineers have proven their skill in the design and proportioning of this machine tool. Constructed on the unit plan this machine is characterized by its rigidity — ease of operation — and precise results. Write for descriptive catalog No. T10.

KEARNEY & TRECKER

Products

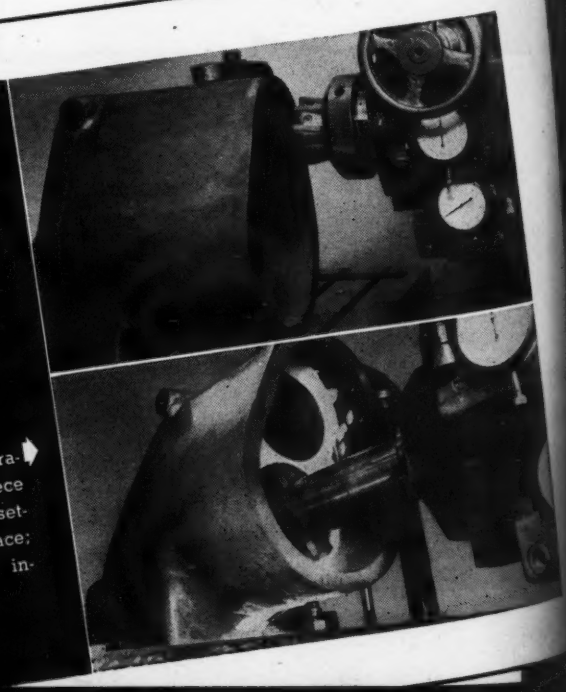
CORPORATION

MILWAUKEE 14, WISCONSIN

Subsidiary of Kearney & Trecker Corporation

BUILDERS OF MILWAUKEE ROTARY HEAD MILLING MACHINE • MIDGETMILL • SPEEDMILL • FACE MILL GRINDER • AUTOMETRIC BORING MACHINES.

Illustration shows convenient operating height, and ease of operation with all controls within operator's reach.



Illustrating two operations on same workpiece without change of setup. Top: milling the face; bottom: boring the inside diameter.

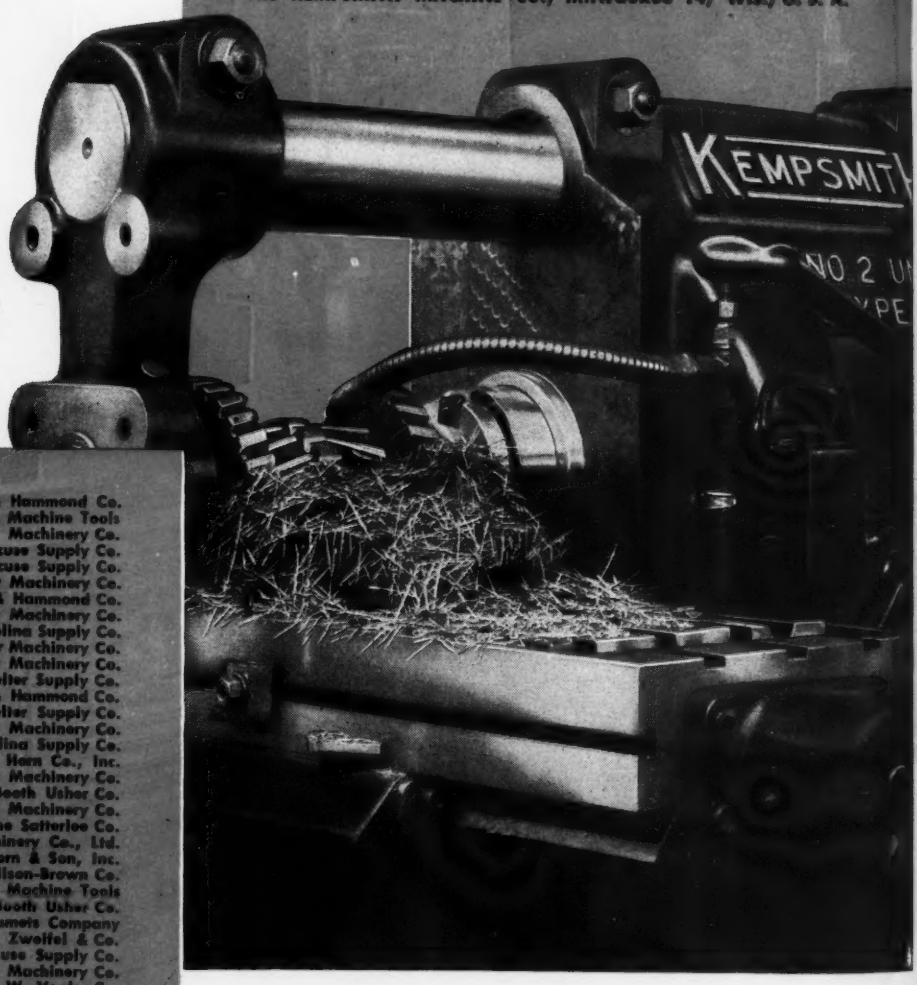
KEARNEY & TRECKER
MILWAUKEE
Precision Milling and Boring Machine
No. 3 MODEL T

Make the job FIT *the Machine*

You wouldn't expect this youngster to engage a prize fighter . . . nor should you select a small machine tool for heavy-duty milling operations. Make the job FIT the machine. When you have a milling job that calls for unusually heavy cuts, put it on a rugged KEMPSMITH. Then you KNOW the job will be done with precision and accuracy. For KEMPSMITH Millers have what it takes for those tough production battles . . . built-in ruggedness . . . increased range of speeds and feeds . . . greater power . . . backed by more than a half-century of milling machine experience. Remember, there is no substitute for RUGGEDNESS! Play safe, by putting the job on a rugged KEMPSMITH!

The KEMPSMITH MACHINE CO., Milwaukee 14, Wis., U. S. A.

Phone YOUR NEAREST KEMPSMITH DISTRIBUTOR



AKRON, O.	Strong, Carlisle & Hammond Co.
BALTIMORE, MD.	Albert Hepworth Machine Tools
BOSTON, MASS.	Wigglesworth Machinery Co.
BINGHAMTON, N. Y.	Syracuse Supply Co.
BUFFALO, N. Y.	Syracuse Supply Co.
CHICAGO, ILL.	E. L. Essley Machinery Co.
CLEVELAND, O.	Strong, Carlisle & Hammond Co.
COLUMBUS, O.	C. H. Gesiger Machinery Co.
CONCORD, N. C.	Carolina Supply Co.
DALLAS, TEXAS	Hamilton-Huster Machinery Co.
DAYTON, O.	C. H. Gesiger Machinery Co.
DENVER, COLO.	Mine & Smelter Supply Co.
DETROIT, MICH.	Strong, Carlisle & Hammond Co.
EL PASO, TEXAS	Mine & Smelter Supply Co.
GRAND RAPIDS, MICH.	E. L. Essley Machinery Co.
GREENVILLE, S. C.	Carolina Supply Co.
HOUSTON, TEXAS	Oliver H. Van Horn Co., Inc.
INDIANAPOLIS, IND.	State Machinery Co.
LOS ANGELES, CALIF.	Smith Booth Usher Co.
MILWAUKEE, WIS.	E. L. Essley Machinery Co.
MINNEAPOLIS, MINN.	The Satterlee Co.
MONTREAL, QUE.	Moore Bros. Machinery Co., Ltd.
NEW ORLEANS, LA.	Van Horn & Son, Inc.
NEW YORK, N. Y.	Harrington-Wilson-Brown Co.
PHILADELPHIA, PA.	Albert Hepworth Machine Tools
PHOENIX, ARIZ.	Smith Booth Usher Co.
PITTSBURGH, PA.	Wm. K. Stamets Company
PORTLAND, ORE.	Geo. E. Zwoifel & Co.
ROCHESTER, N. Y.	Syracuse Supply Co.
ROCK ISLAND, ILL.	E. L. Essley Machinery Co.
ST. LOUIS, MO.	John W. Vogler Co.
SALT LAKE CITY, UTAH	The Lang Company
SAN FRANCISCO, CALIF.	C. F. Bulotti Machinery Co.
SEATTLE, WASH.	Buckner Weatherby Co., Inc.
SHREVEPORT, LA.	Oliver H. Van Horn Co., Inc.
STAMFORD, CONN.	Harrington-Wilson-Brown Co.
SYRACUSE, N. Y.	Syracuse Supply Co.
TOLEDO, O.	Strong, Carlisle & Hammond Co.
TORONTO, ONT.	Rudel Machinery Co., Ltd.
WASHINGTON, D. C.	Albert Hepworth Machine Tools
WINDSOR, ONT.	Rudel Machinery Co., Ltd.

KEMPSMITH

Precision Built Milling Machines Since 1888

December, 1945

ROCKFORD Metalworking Production Ideas

Battery of Barber-Colman Type D Hydraulic Hobbing Machines, used for hobbing gears in tractor production, at Caterpillar Tractor Company, Peoria.

AMERICAN BROACH & MACHINE CO. ★ ANDERSON BROS. MFG. CO. ★ BARBER-COLMAN COMPANY

BARNES DRILL CO. ★ JOHN S. BARNES CORP. ★ W. F. & JOHN BARNES CO.

GREENLEE BROS. & CO. ★ MATTISON MACHINE WORKS ★ REHNBERG-JACOBSON MFG. CO.

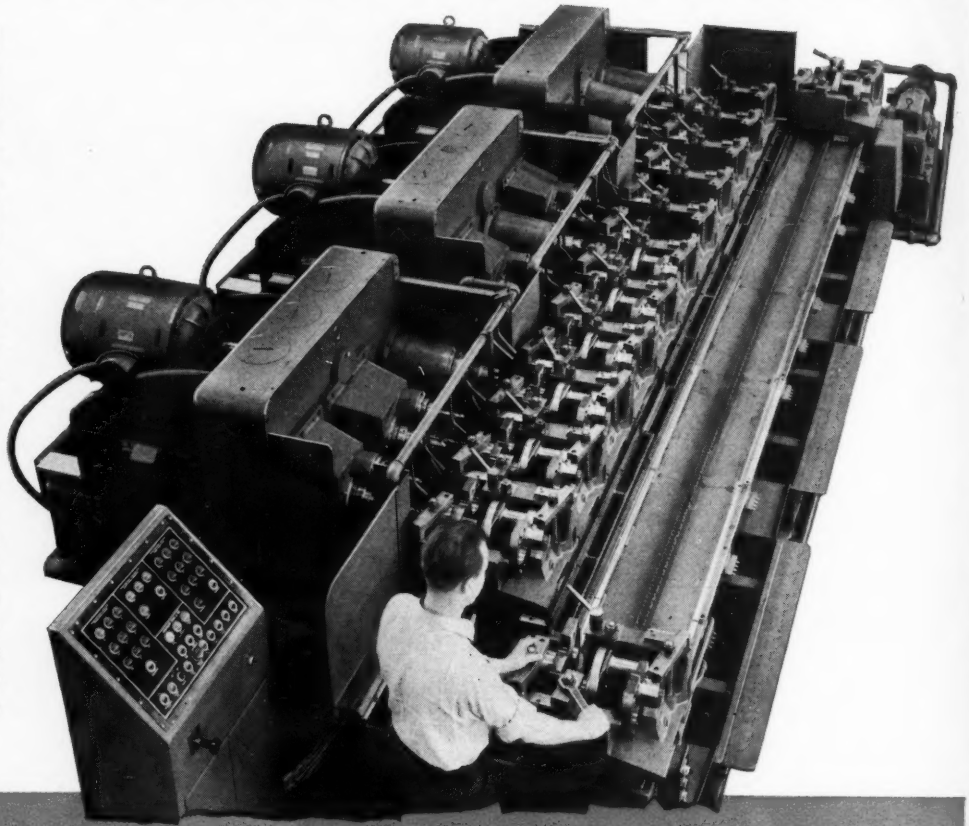
ROCKFORD CLUTCH DIVISION ★ ROCKFORD MACHINE TOOL CO. ★ SUNDSTRAND MACHINE TOOL CO.

Borg-Warner Corporation

13-STATION TRANSFER MACHINE

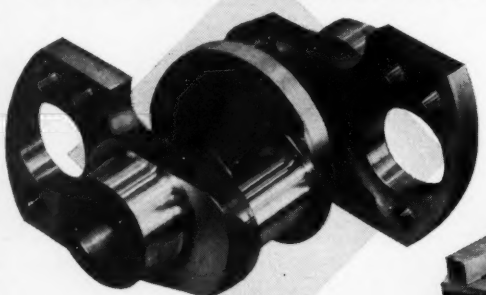
DESIGNED AND BUILT BY GREENLEE FOR DRILLING, BORING, AND COUNTERBORING 12 HOLES IN TWO COUNTERBALANCES ON AN ENGINE CRANKSHAFT

The two most unique features of this machine are the reversible work-holding fixture and the chain conveyor, which returns the fixture to the operator after it has gone down the line. These features enable *one man* to perform all the necessary operations—loading and unloading the pieces, and reversing the fixture for its second pass through the machine. The three heads, equipped with suitable tooling, perform the following operations on each counterbalance flange: (1) trepan, rough, and finish bore one 3.735" hole; (2) drill, rough and finish counterbore, and finish bore four 1.250"-.9375" holes; (3) drill and redrill one 2⅝" hole. The parts are automatically transferred down the line of working positions as these operations are performed. *This makes an extremely efficient and accurate machining set-up requiring only one operator to keep it going.*



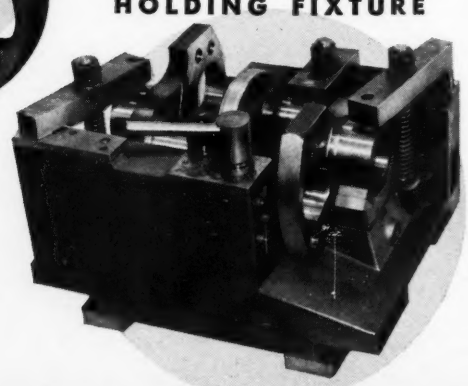
GREENLEE

FINISHED CRANKSHAFT



Note that each work piece is clamped in a special fixture, as shown at the left. When the piece has gone through the machine and one counterbalance has been completely finished, the fixture is returned to the operator by the chain conveyor. He then turns the fixture end-for-end and sends it through the machine for a similar sequence of operations on the second counterbalance. *Average production is eight completed crankshafts per hour.*

HOLDING FIXTURE



PRODUCTION MACHINERY

GREENLEE

GREENLEE BROS. & CO.
1872 MASON AVE.
ROCKFORD, ILLINOIS

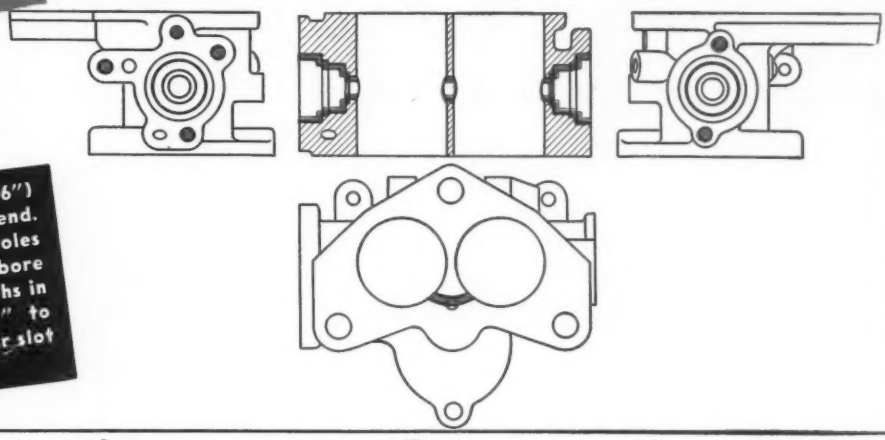
MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

MADE IN ROCKFORD... TESTED ENGINEERING AND CRAFTSMANSHIP
ILLINOIS, U.S.A.

DO YOU HAVE A PRODUCTION PROBLEM?

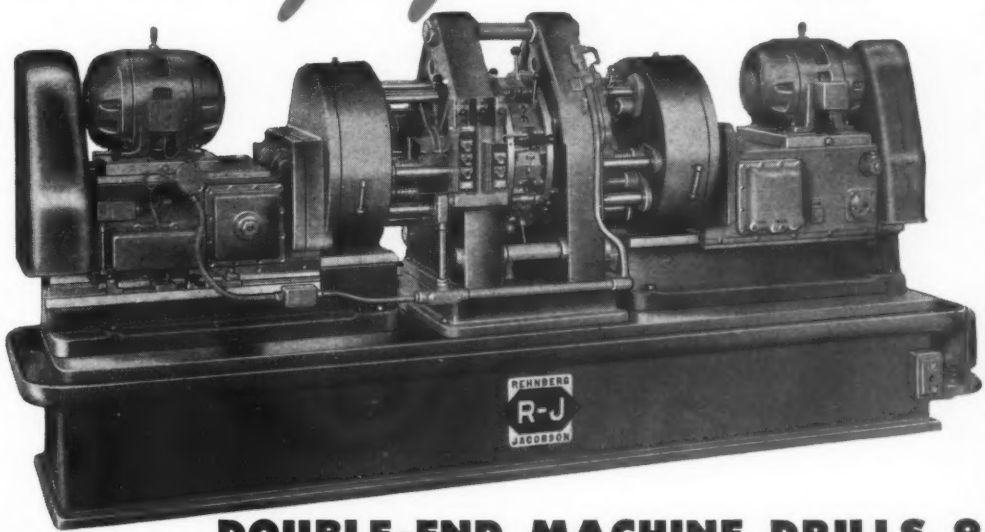
"A PRODUCTION PROBLEM! WE HAVE LOTS OF THEM!"

CARBURETOR BODY

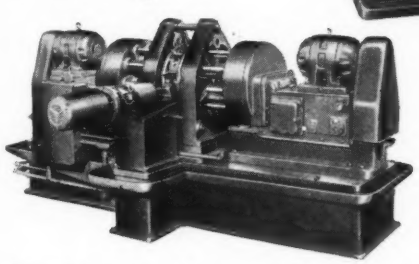


OPERATIONS. Drill 4 #20 (.116") holes one end, 2 in the other end. Drill and ream 3 .281/.284" holes in line through body. Counterbore 4 diameters to specified depths in each end, limits from .001" to .004". Trepan partial circular slot at angle in top face.

Rehnberg-Jacobson



REAR VIEW



ALSO MACHINES ANOTHER PART

By changing the work-holding fixtures, removing several tools, and changing other tools, the same machine is easily converted for a similar, but less elaborate, series of operations on another part of the carburetor. This double-purpose feature is designed into the machine to reduce machine tool expense and improve production economy.

DOUBLE-END MACHINE DRILLS 9 HOLES, COUNTERBORES 8, AND TREPANS ANGULAR SLOT

This is a high-production job — machining the bodies for standard automotive carburetors. The machine shown above handles a group of related operations, 18 in all. Partly-finished castings are loaded and quickly hand-clamped in fixtures on the R-J Vertical Index Drum in the center of the machine. By hand-index they are passed through eight successive working positions, where the proper sequence of operations is performed by tools mounted in special heads of our own design and manufacture. Driving and traverse power is provided by W. F. & John Barnes hydraulic units. The trepanning tool comes in from the back of the machine, driven by a Rehnberg No. 3 Drill Unit. *Take advantage of Rehnberg-Jacobson engineering ingenuity and manufacturing skill and let us help you solve YOUR production problems.*

REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

REHNBERG R-J JACOBSON

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

MADE IN

FOR RIGID ACCURACY IN MACHINE TOOLS...ROCKFORD ILLINOIS, U.S.A.

Straightening PRESS

for Heavy Work

Traveling Ram Rolls Easily

. . . Accurately Placed by Hand Wheel

With the traveling ram positioned at one end of the table a crane can lower heavy work into place then the ram can be placed, wherever required, over the work.

The ram rolls on four ball bearing equipped wheels and is easily moved into position by means of a hand wheel.

The table is equipped with a "V" slide on which are mounted spring loaded centers and checking rolls. The bed is a welded structure 11 feet long, however, the length can be made to suit a customer's requirements. Length of stroke 6". Longer strokes available to meet individual needs. Power requirements are a 3 h.p. motor.

Send for Bulletin No. 12-6

Anderson Indicator Takes Guesswork Out of Straightening

It tells the Operator

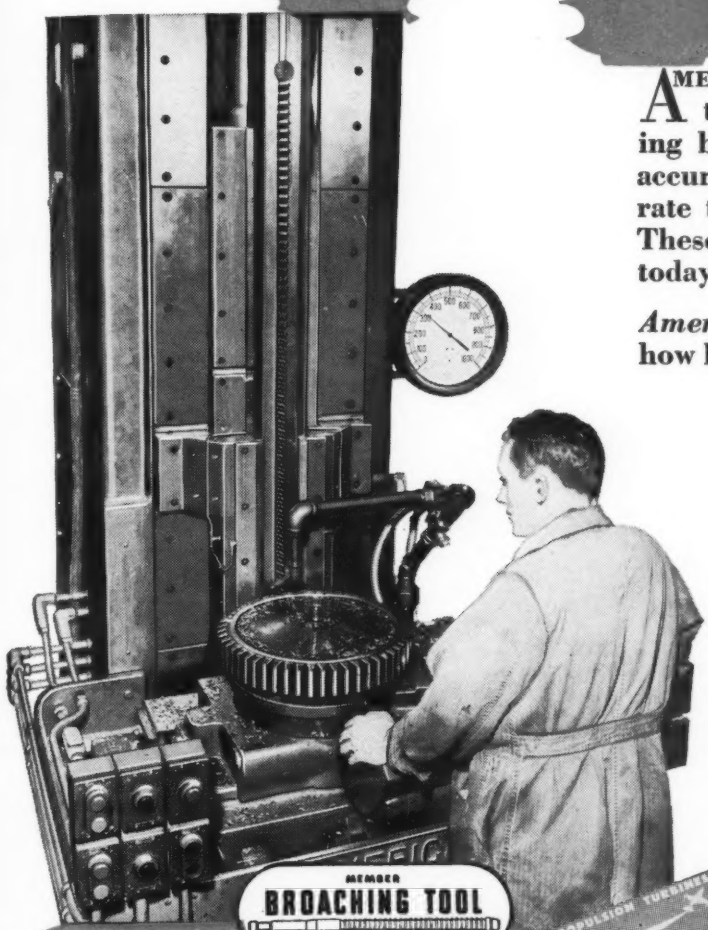
1. The exact amount of runout.
2. Where to stop the shaft and do straightening.
3. During the pressure operation, it indicates how much shaft is being bent.
4. As soon as pressure is released it shows result of first straightening "try" and gives a guide for the next operation.

ANDERSON BROS. MFG. CO.
Anderson
ROCKFORD, ILL. U.S.A.

MADE IN
ROCKFORD...FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION
ILLINOIS, U. S. A.

JET PROPULSION TURBINES *by* BROACHING . . .

Step 3



AMERICA'S record-breaking output of munitions during the war proved that broaching by *American* was capable of performing accurate metal finishing operations at a faster rate than was possible by any other method. These advantages are even more important in today's highly competitive economy.

American engineers will be glad to show you how broaching will work for you in your plant. There is no obligation. Write today for details on *American's* complete broaching service—machines, tools, and engineering.

Finishing slots in jet propulsion turbines was a typical wartime problem solved by broaching, the *American* way. An *American* SB-66-15 Vertical Surface Broaching Machine, equipped with a single broach, was used to cut the finished form in the sides of the previously semi-finished grooves. By broaching, the entire form was held within tenths of thousandths at an extremely high rate of production.

MEMBER BROACHING TOOL INSTITUTE

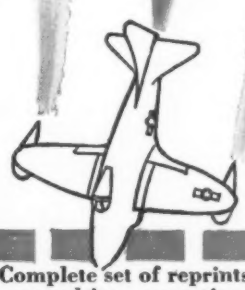
American BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.



FREE! Complete set of reprints on jet propulsion operation. The three *American* advertisements describing the broaching of jet propulsion turbines will be sent to you without obligation. Just attach this convenient coupon to your letterhead!

NAME_____

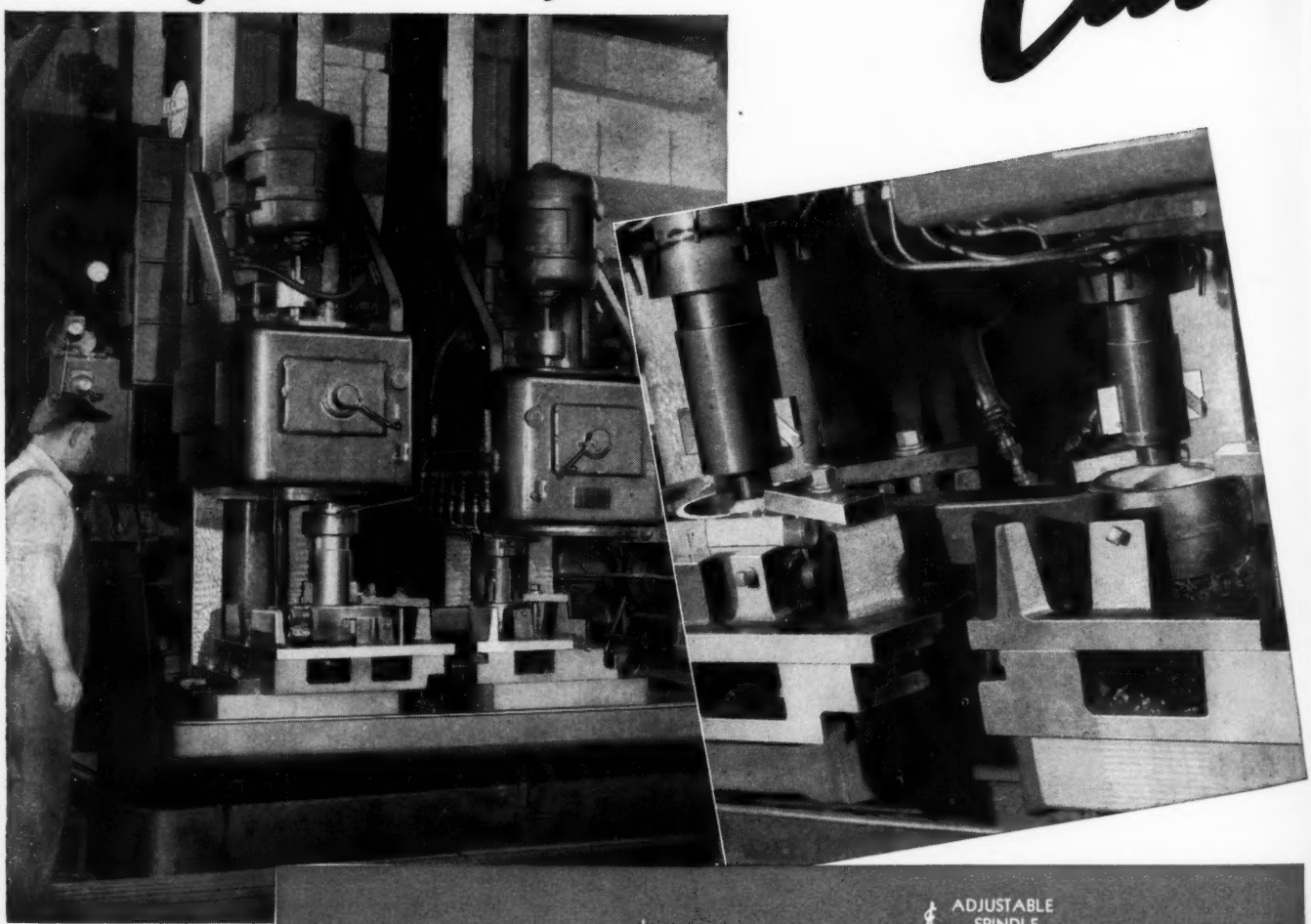
TITLE_____

MADE IN

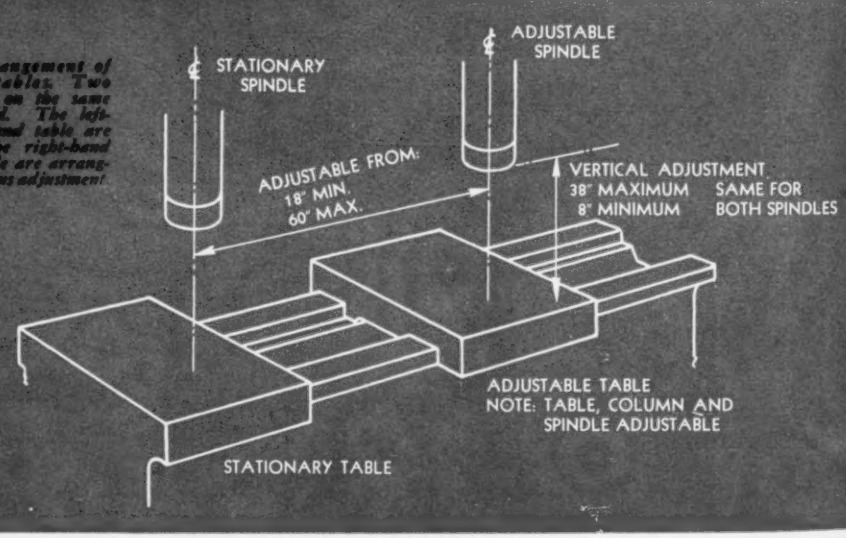
CENTER OF MACHINE TOOL EXCELLENCE . . . ROCKFORD ILLINOIS U.S.A.

CRANK PIN AND WRIST

Boring Operations Cut



Schematic arrangement of spindles and tables. Two tables mounted on the same bed are utilized. The left-hand column, and table are stationary. The right-hand column and table are arranged for simultaneous adjustment



W. F. & JOHN BARNES

W. F. and JOHN BARNES COMPANY, ROCKFORD, ILL., *Special* MACHINE TOOLS

MADE IN ROCKFORD... FOR ACCURATE, FAST METAL REMOVAL

ILLINOIS, U. S. A.

PIN HOLE

2 hours, 11¾ minutes

Barnes Vertical Boring Machine Handles Various Sizes of Connecting Rods

Machining time on boring operations on crank pin and wrist pin holes in connecting rods was cut from 204 minutes to 72¼ minutes with this W. F. and John Barnes 2-Column Vertical Boring Machine. The machine is designed to handle various sizes of connecting rods. Because of its automatic operating cycle, the operator can assemble the studs and caps onto other rods during machine operation.

This job is another excellent example of special machine design for high production boring of connecting rods. The two hydraulically-actuated sliding heads on the Barnes machine may also be operated as two independent boring machines. The heads are driven by two-speed motors. Machine is provided with manual selection for fast feed, slow feed, and reverse feed. The two-speed motor and a manual shift for quick gear change give four spindle speeds. Pick-off gears give an additional range of speeds from 12 to 400 r.p.m.

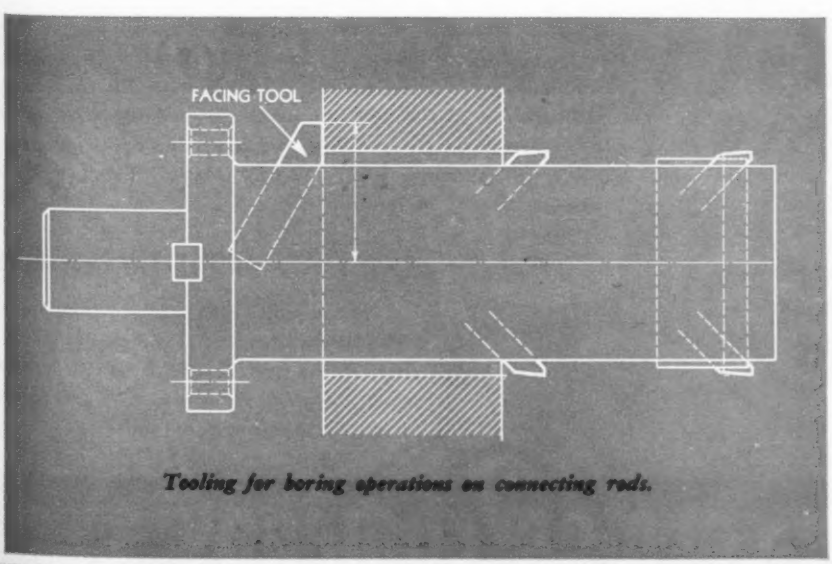
The left-hand column and table are stationary; while the right-hand column and table are arranged for simultaneous adjustment. Spindle centers are adjustable from 18″ minimum to 60″ maximum. The machine has a 30″ feed stroke and the distance from the fixture platen to the spindle nose is 8″ minimum — 38″ maximum. Spindles are of alloy steel, mounted in heavy duty anti-friction bearings.

Rough and semi-finish boring operations can be combined on one bar because of the long bearings on the spindles. The long saddles on the two hydraulic sliding heads makes it possible to adapt this machine for stub boring, with feed rates from ⅛″ to 7″ per minute. Controlled by pushbutton panel, the operator can select either manual or automatic machining cycle at will. Manual control permits fast feed, slow feed and reverse feed. Positive lubrication of the sliding heads and machine ways is also provided.

How to Get Special Machine Tools for Multiple Machining Operations

This manufacturer obtained this outstanding reduction in costs and machining time by submitting blueprints and production requirements to Barnes engineers who designed the Vertical Boring Machine to handle connecting rods of varying sizes and diameters. The machine can also be converted to other production boring jobs by making changes in tooling and work holding fixtures.

If you have similar boring jobs, or other multiple machining operations which include *drilling, boring, reaming, tapping, facing, milling* or *honing,* you can obtain the same design service and Barnes Special Machine Tools for your specific requirements by submitting drawings and production data to our engineers. There is no obligation.



Tooling for boring operations on connecting rods.

Additional Data

on W. F. and John Barnes SPECIAL MACHINE TOOLS which includes Performance Data on actual metal working jobs in the field, will be sent to key production personnel on request. Barnes Performance Data may suggest a tooling or a production setup you can use today. The SPECIAL MACHINE TOOLS book (No. 1245) will be sent without cost.

FOR DRILLING, REAMING, TAPPING, BORING, FACING, MILLING AND HONING OPERATIONS

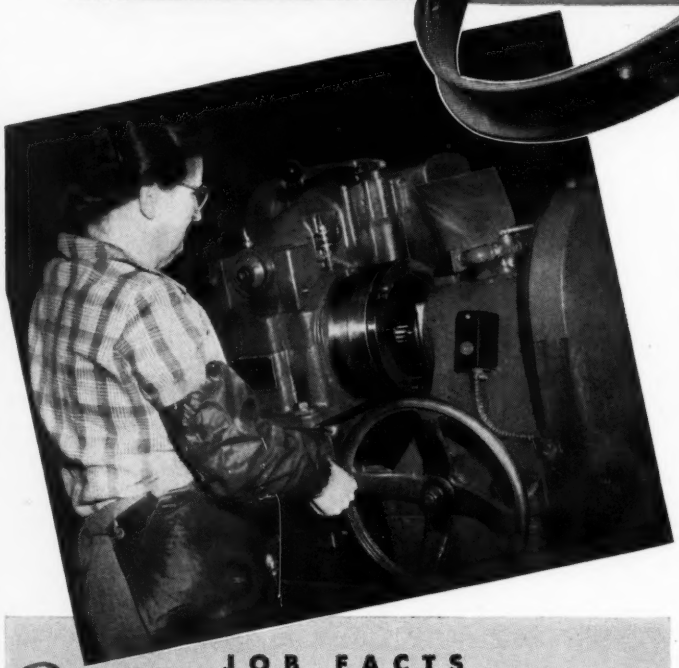
MADE IN

YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN...ROCKFORD

ILLINOIS, U.S.A.

16 PITCH THREADS MILLED IN 8⅛" DIAMETER ALLOY STEEL NUT!

...Using B-C Shank Type Precision Ground Multiple Tooth Thread Mills



The accuracy required in thread milling internal 16 pitch threads in an 8-⅛" diameter piston gasket nut is consistently maintained with Barber-Colman Shank Type Precision Ground Thread Mills. These piston gasket nuts made of alloy steel (43 Rockwell C) with frequent hard spots are milled one every 7.34 minutes; with a cutter speed of 290 r.p.m. and feed of 4" per minute. The distance which the cutter travels around the inside diameter of the nut is 29 inches. The B-C Precision Ground Thread Mills produce a total of 27 pieces between sharpenings.

Here is another example where multiple thread milling cutters were designed by Barber-Colman to handle a specific milling job. Parts with short outside or inside threads, where uniformity of duplication is essential, are produced with constant accuracy, because this *accuracy* is built into the cutter rather than being dependent entirely upon operator skill.

JOB FACTS

Material—Alloy Steel, 43 Rockwell C. Frequent hard spots.
Operation—Thread mill 16 pitch threads, 8-1/8" diameter, in piston gasket nut.
Machine—Lees-Bradner.
Cutter—B-C Shank Type Precision Ground Thread Mill
Feed—4" per minute.
Cutter Speed—290 r.p.m.
Cutting Time—7.34 minutes.
Tool Life—27 pieces per sharpening.

High Production Thread Milling Performed Economically and Accurately

Where a high degree of accuracy and fine finish are required, together with quantity production, B-C high quality precision ground spiral thread mills may be particularly well adapted. The spiral gash in B-C thread mills promotes a shearing action in the cut and maintains a continuous cutting action from flute to flute. Chatter and vibration are eliminated, resulting in better, accurate finish, greater tool life, and low cost per piece milled.

Whether standard, made-to-order, or designed for the particular milling job, Barber-Colman milling cutters give greater production, precision accuracy, longer tool life and lower milling costs. B-C Cutter Engineers are available to assist you in checking over your milling operations and developing profitable milling applications in your plant. This service is without cost or obligation.

Send for FACTS ABOUT THREAD MILLS

. . . twelve page bulletin full of useful information on thread mills and thread milling jobs direct from the field. If you haven't received a copy, write today, giving the name of your company and title.

HOBBING MACHINES, HOBS, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

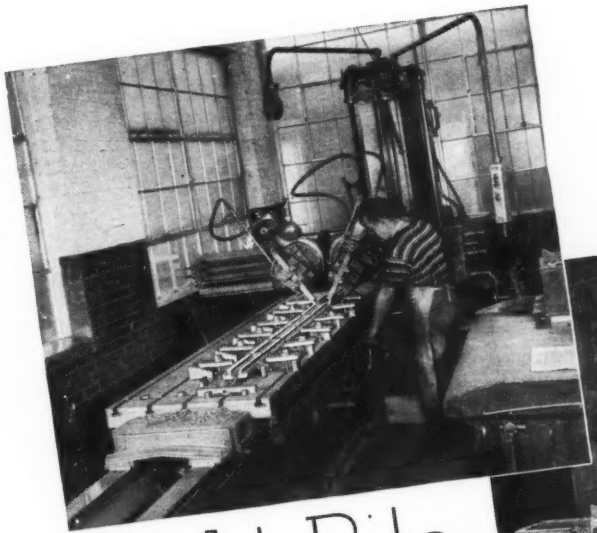
BARBER-COLMAN COMPANY

GENERAL OFFICES AND PLANT • 109 LOOMIS ST. • ROCKFORD, ILL., U.S.A.

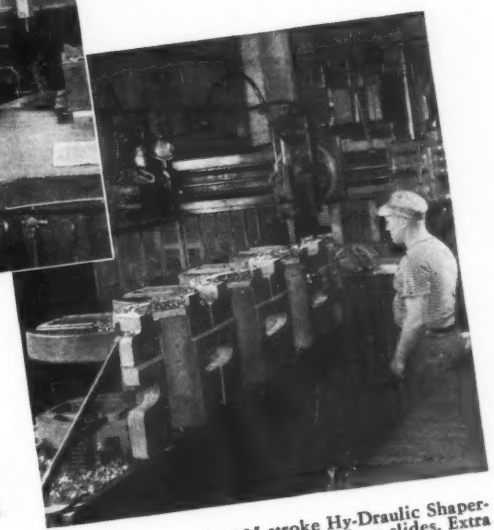
BARBER B-C COLMAN

MADE IN **ROCKFORD**... MACHINE TOOL SHOPPING CENTER ILLINOIS, U.S.A.

Hy-Draulic



Hy-Draulic 4518

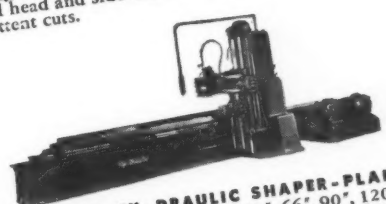


Light Bite or a Mouthful

Hy-Draulic Shaper-Planer Work Is ACCURATE • FAST • EASY

Handy, powerful, durable, the Hy-Draulic Shaper-Planer is particularly effective on pieces that are too big for large shapers yet too small for economical production on planers. Accurate, fast, easy to operate. It handles such a wide variety of work, light, medium and heavy, that it quickly becomes one of your most profitable investments. Investigate the advantages of hydraulic drive and feeds in the Rockford Hy-Draulic Shaper-Planer. Write, today, for Bulletin 1528.

- Above, left . . . A 120" stroke Hy-Draulic Shaper-Planer, planing dovetails on cast-iron slides. Extra crossrail head reduces planing time.
- Above, right . . . Same Shaper-Planer roughing a gang of cast steel steering gear parts. Note crossrail head and side head are both working on intermittent cuts.



ROCKFORD HY-DRAULIC SHAPER-PLANERS
Available in stroke-lengths of 42", 66", 90", 120" and 144". Hy-Draulic Shaper-Planer speeds and feeds are infinitely adjustable in specified ranges.

ROCKFORD MACHINE TOOL CO., ROCKFORD, ILLINOIS

MADE IN

ROCKFORD MADE MEANS PRECISION MADE...ROCKFORD

ILLINOIS U.S.A.

SAVE TIME AND IMPROVE ACCURACY!

...BY TURNING GEAR BLANKS ON SUNDSTRAND AUTOMATIC LATHES

In one manufacturing plant over 100 different sizes of gear blanks, ranging from 1 7/16" O. D. x 5/8" wide to 8 3/16" O. D. to 2" wide, are processed over Sundstrand automatic lathes. Perhaps the method used will prove profitable to you. Here's how it's done:

MACHINING TIME REDUCED 55%

These steel gear blanks were formerly machined from bar stock on a chucking machine and finished on an engine lathe. By machining them on Sundstrand automatic lathes, as shown on opposite page, the total machining time was reduced 55%. In addition, greater accuracy is obtained. This is due to the fact that finish facing of both sides and turning of the O. D. is done simultaneously in the final operation. Finished surfaces are held to within .001" in relation to the hole which is used as the locating surface for both the finish turning operation and the hobbing or tooth cutting operation.

TIME SAVED ON BOTH SHORT AND LONG RUNS

Gear blanks are processed in lot sizes from 20 to 100 pieces. The Sundstrand quick cycle changeover makes it possible to include small lot turning operations on this multiple tooled automatic lathe. The approximate changeover time on gear blanks of this type is less than 30 minutes.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

RIGIDMILS | FLUID-SCREW RIGIDMILS | AUTOMATIC LATHES | HYDRAULIC EQUIPMENT

MADE IN **ROCKFORD**...CITY OF MACHINE TOOL SPECIALISTS

TYPICAL PROCESSING METHOD

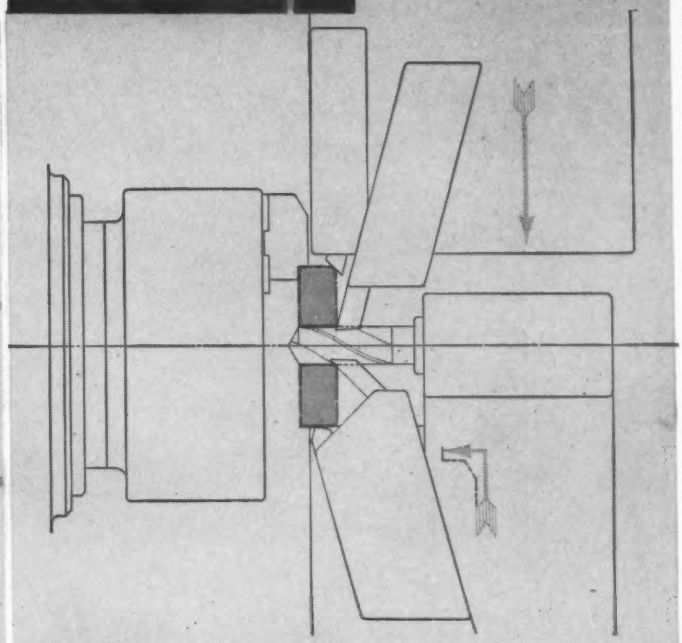
These tooling diagrams illustrate the sequence of operations in turning gear blanks. Additional detailed information is included in the 44 page book offered below.

1. Rough drill hole from solid, chamfer one corner of I. D. Rough turn half of O. D. chamfer O. D. Rough face one side.

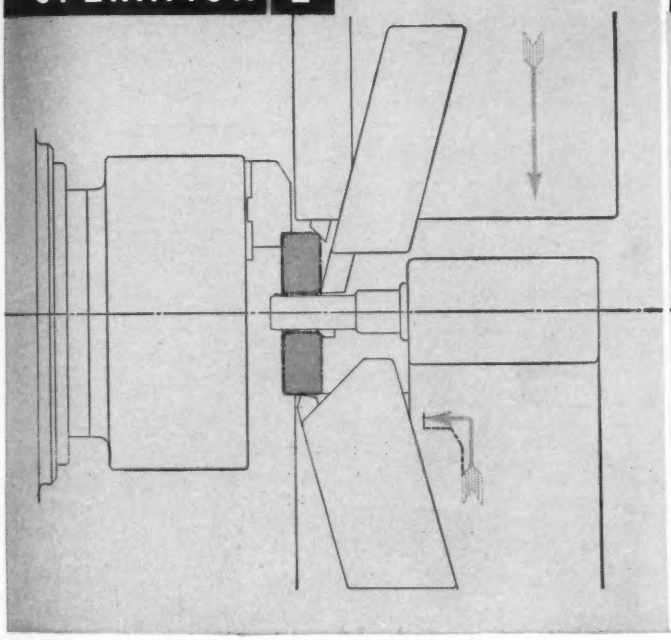
2. Reverse part. Perform same operations as #1 on opposite side and finish bore hole to ± .0005". Hand ream the hole to + .0005", − .000".

3. Place blank on arbor. Finish face both sides, O. D. and chamfer. Part located from bore which is later used as locating point for gear cutting.

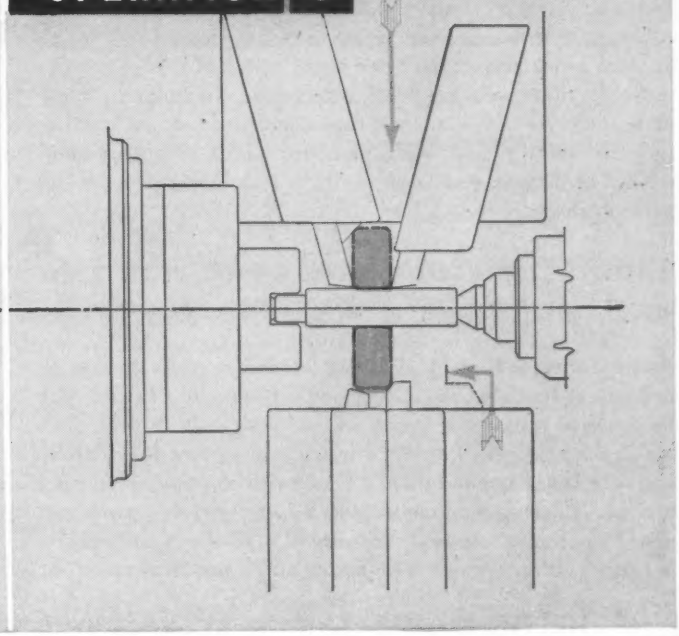
OPERATION 1



OPERATION 2



OPERATION 3



free GUIDE TO FASTER TURNING OF BOTH LONG AND SHORT RUN WORK

This free 44-page booklet contains helpful tips on processing turning jobs, together with illustrations and tooling diagrams. Complete engineering and production data are given on many jobs similar to yours. Write for your free copy today. Ask for Bulletin 643.

DRILLING AND CENTERING MACHINES

SPECIAL MILLING AND TURNING MACHINES

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

SUNDSTRAND MACHINE TOOL COMPANY

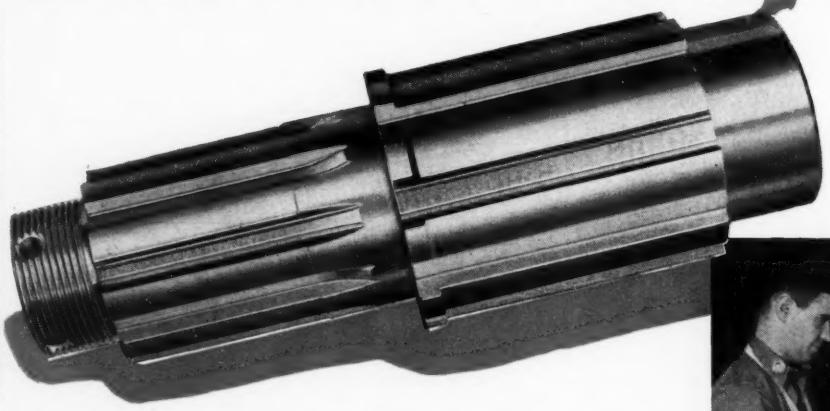
2530 Eleventh St. • Rockford, Ill., U. S. A.

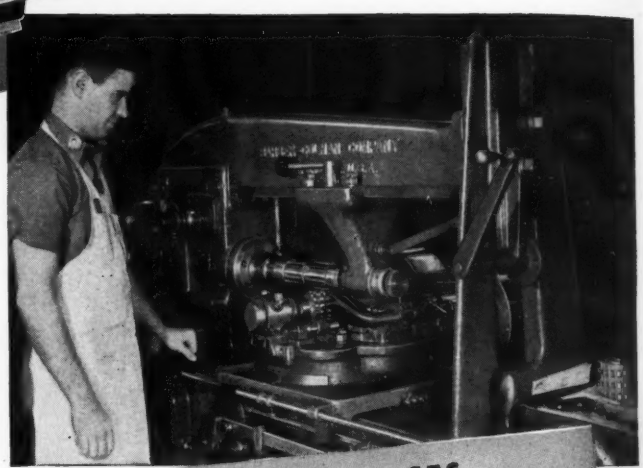
MADE IN

FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD

ILLINOIS, U.S.A.

SPLINE KEYS HOBBED *with Accuracy in "Tenths"*





+.0005" On Key Width and Root Using B-C Type A Hobbing Machine and B-C Hobs

● Both splined sections on this drive shaft are hobbed on a B-C Type A Hobbing Machine using B-C special ground spline hobs. The material is hard and tough (NE 9445, 33-37 Rockwell), yet these parts are being produced consistently to limits of ±.0005" on key width and root diameter. One cut conventional hobbing is used and production time for the large end is only 35 minutes floor-to-floor. The hobs average ten shafts per hob sharpening.

BRIEF JOB FACTS

Material—NE 9445 heat treated steel (33-37 Rockwell C)

Operation—Hobbing 10 key splines 2-7/16" long and 3-3/4" long.

Hobbing Machine—Barber-Colman Type A Hobbing Machine.

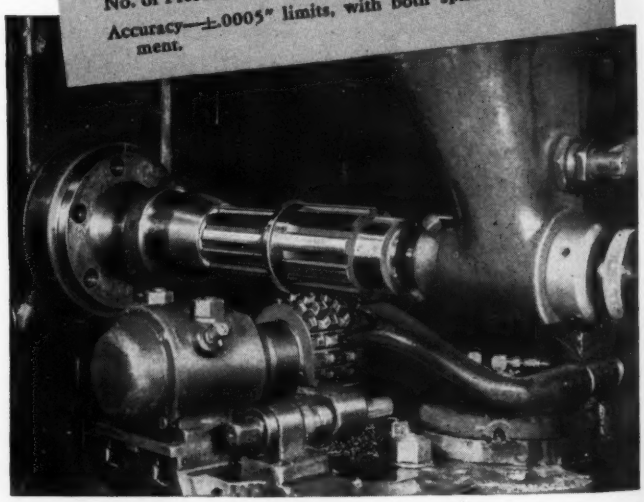
Feed—.0375" per revolution of work.

Speed—60 r.p.m.

Production—35 minutes floor-to-floor time for 3-3/4" long spline.

No. of Pieces per Grind—10.

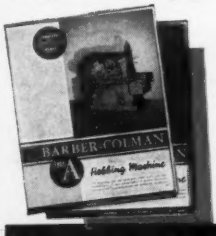
Accuracy—±.0005" limits, with both splines in alignment.



Superior Results and Long Hob Life With B-C Type A Hobbing Machines

Barber-Colman Type A Hobbing Machines make it easy to hold close limits and low costs on a production basis. The machine is designed and constructed with built-in precision, making it possible to produce spline shafts more easily, faster and at lower cost than by any other method. Universal in type, it is particularly adaptable to both high production work and general-purpose hobbing. Capable of high speed and feed, it produces hobbed forms with better finish and increased tool life.

Why not let B-C Hobbing Engineers assist you in checking your hobbing requirements. There is no obligation of course and you will be pleased with the flexibility this equipment offers for general shop production.



Send **FOR BULLETIN F-1099 TODAY.** This bulletin contains complete description and specifications of the Type A Hobbing Machine.

HOBBING MACHINES, HOBS, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

BARBER-COLMAN COMPANY

GENERAL OFFICES AND PLANT • 109 LOOMIS ST. • ROCKFORD, ILL., U.S.A.

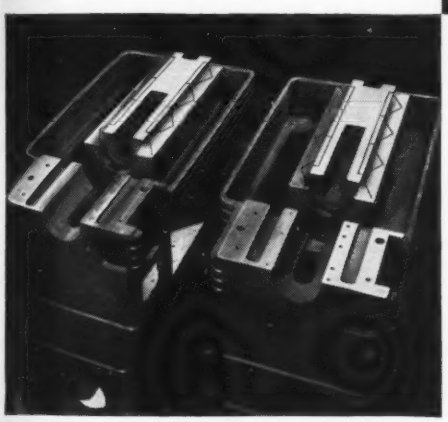
BARBER B-C COLMAN

MADE IN ROCKFORD... MACHINE TOOL PLANTS CLOSE TO YOUR PLANT

ILLINOIS U.S.A.

TIME CUT FROM 10 HOURS TO 1½ HOURS

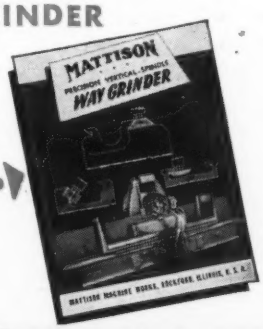
WITH MATTISON WAY GRINDER

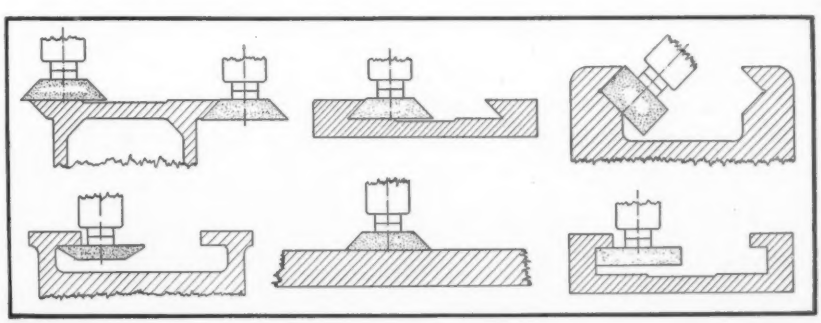


The two Boring Machine bases shown above are ground in 3 hours (1½ hours per casting) on the Mattison Precision Vertical-Spindle Way Grinder as compared to 10 hours each previsouly required for hand scraping. Head pads and ways are ground in one setting, being finished in perfect alignment. Because of time savings like this, man hours have been cut 75% in the finishing department of a prominent Detroit manufacturer.

Tables, Slides, Saddles, Heads, and other parts having angular ways or surfaces are ground to closest accuracy and fine finish with the Mattison Way Grinder. You are able to eliminate the costly hand scraping operation as well as finish parts having hardened ways.

SEND FOR FREE CIRCULAR GIVING FULL DETAILS REGARDING THIS NEW WAY GRINDER





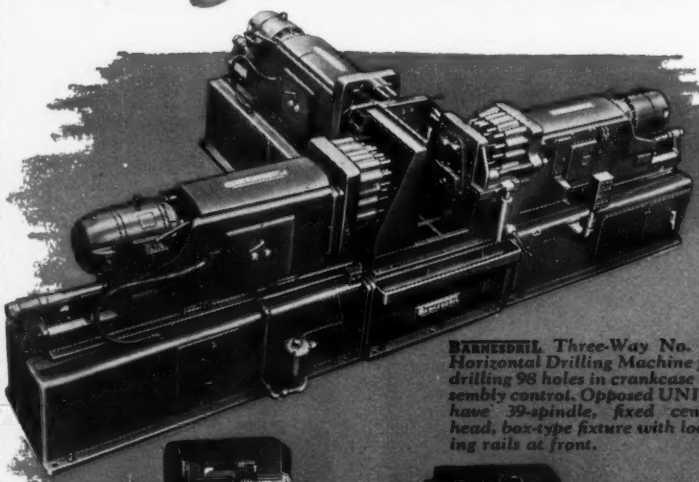
MATTISON MACHINE WORKS

ROCKFORD • ILLINOIS

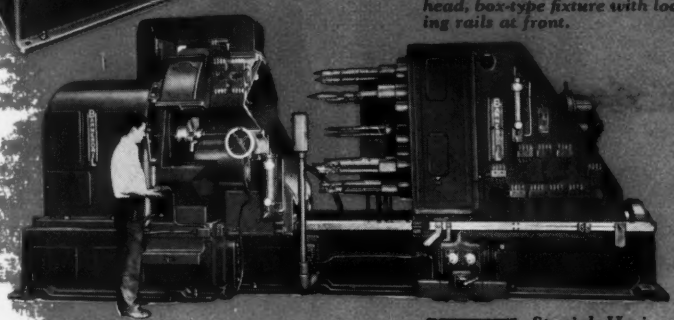
MADE IN ROCKFORD ILLINOIS U.S.A.

FOR METAL REMOVAL WITH ACCURACY AND SPEED...

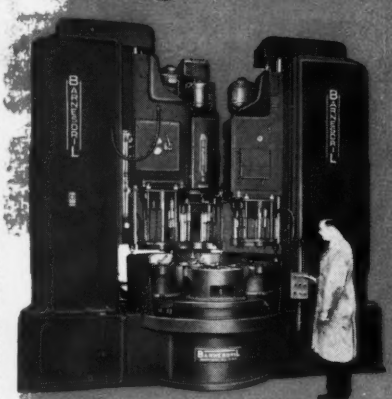
How to obtain
MAXIMUM PRODUCTION at LOWER COST
with *Standard* Machines for *Special* Operations



BARNESDRIL *Three-Way No. 20 Horizontal Drilling Machine for drilling 98 holes in crankcase assembly control. Opposed UNITS have 39-spindle, fixed center head, box-type fixture with loading rails at front.*



BARNESDRIL *Special Horizontal Drum Type Indexing Production Machine for drilling and taper reaming nozzle holes with traveling horizontal 34-spindle auxiliary head.*



BARNESDRIL *Three-UNIT Vertical No. 10 Hydraulic Production Machine for simultaneous machining operations on aluminum pump housing parts.*

BARNESDRIL *Three-Unit Machine for drilling 26 holes in rear axle housing. Vertical UNIT has 18-spindle auxiliary head. The two opposed horizontal UNITS have 8-spindle auxiliary heads.*

Here is complete information and data on BARNESDRIL Standard Hydraulic Units for *special* Drilling, Reaming, Facing, Boring and/or Tapping Operations. Write *today* for your copy of this Bulletin No. 150M.

• Where *special* drilling, reaming, facing, boring and tapping operations must be performed, BARNESDRIL Standard Hydraulic Units present a fast, low-cost method for specialized high production machining.

The unusual flexibility of BARNESDRIL Standard Hydraulic Units permits their arrangement in any vertical, horizontal or angular position (as shown), or they can be grouped around a rotating indexing table. A wide range of production work, limited only by size, design and construction of the workpiece, are regularly handled with BARNESDRIL Standard Hydraulic Units.

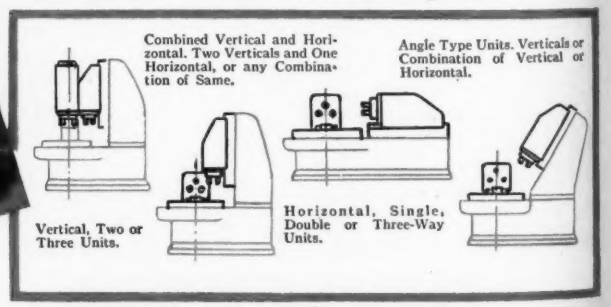
Completely self-contained, BARNESDRIL UNITS are arranged for the most efficient handling of the work, with a single motor driving the spindle rotations and hydraulic pump for any required automatic hydraulic feed cycle. Interchangeable single-spindle or multi-spindle auxiliary heads, with any required number of spindles, are easily mounted on the flange support of the UNIT.

Through the use of BARNESDRIL UNITS, engineering and development costs of *special* machines may be entirely eliminated. They are regularly available in the following three sizes, motorized according to job requirements:

No. 5 Unit.....with 5 to 7½ hp. motor
No. 10 Unit.....with 10 to 15 hp. motor
No. 20 Unit.....with 20 to 25 hp. motor
Drum Type and Specials..up to 75 or more hp.

They can be easily and economically converted from one high production setup to another, and their future use is practically unlimited.

BARNESDRIL UNITS give maximum production at lower costs—with worthwhile savings in both machining and handling time. BARNESDRIL engineers will assist you in adapting these UNITS to your *special* drilling, reaming, facing, boring and/or tapping operations. This service is available without cost or obligation.


Combined Vertical and Horizontal. Two Verticals and One Horizontal, or any Combination of Same.
Angle Type Units. Verticals or Combination of Vertical or Horizontal.
Vertical, Two or Three Units.
Horizontal, Single, Double or Three-Way Units.

814 CHESTNUT STREET

Barnes Drill Co. ROCKFORD ILLINOIS, U.S.A.

MADE IN
ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS
ILLINOIS, U.S.A.

Statement of Position—

Until the present tight steel situation is eased, there will be an unbalanced condition in all steel stocks.

There are three principal reasons for this:

1. Labor and coal shortages are currently lowering steel production.
2. Every industry is anxious to get on with reconversion and peacetime production.
3. There is a tremendous backlog of maintenance and repair requirements.

Ryerson stocks, largest in the nation, reflect current conditions. And because of the great load, it is not always possible to supply the desired steel or deliver available steel as quickly as usual. But we are doing everything we can to satisfy every customer's requirements.

When a certain kind or size of steel is not immediately available, every effort is made to suggest satisfactory alternates which buyers may use with confidence.

Ryerson's 103 years of experience in maintaining large and complete stocks and working closely with all industries, makes the recommendations of Ryerson metallurgists and engineers particularly practical and helpful.

We thank our customers for their courtesy and patience, for the confidence they have placed in our judgment when alternates for wanted steels have had to be offered, and for understanding our position.

Ryerson will continue to serve you to the best of its ability from its eleven strategically located plants. Stocks will be brought to normal as quickly as possible. This means that Ryerson will be among the first to have more complete stocks of present scarce steels—that Ryerson will continue to be the largest stock source for steel in the country.

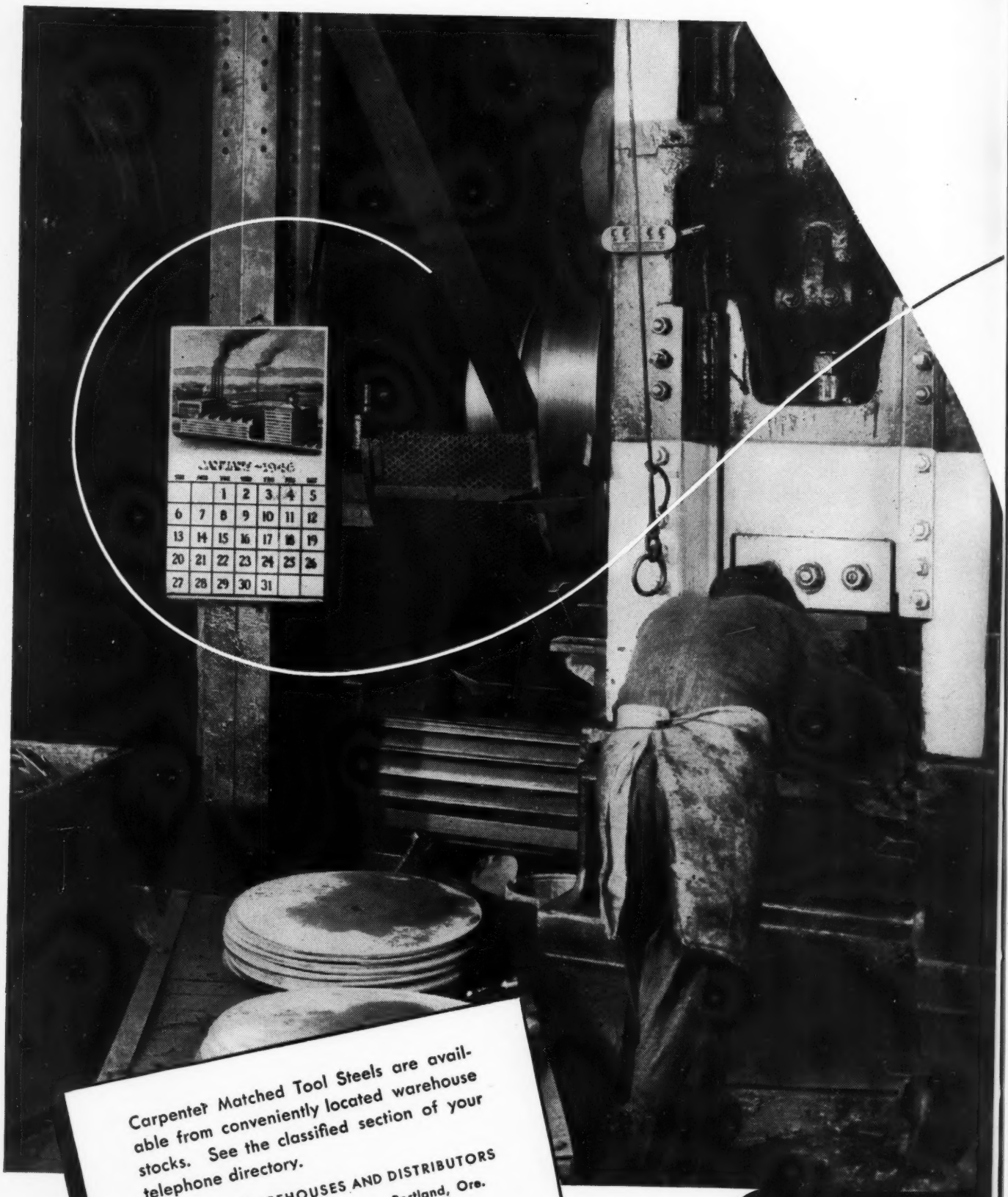
Everett D. Graff

President

JOSEPH T. RYERSON & SON, INC.

RYERSON STEEL

Steel-Service Plants at: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston



Carpenter Matched Tool Steels are available from conveniently located warehouse stocks. See the classified section of your telephone directory.

CARPENTER WAREHOUSES AND DISTRIBUTORS

Baltimore
Boston
Chicago
Cincinnati
Cleveland
Dayton
Detroit
Hartford
Indianapolis
Los Angeles
New York
Philadelphia
Portland, Ore.
Providence
St. Louis
San Francisco
Seattle
Worcester, Mass.

The Standard Tool Steels of Industry

How Much EXTRA Production Can Your TOOLS & DIES Give You Each Month?

Extra output from your tools will cut unit costs. With this 3-step *job analysis* program you can actually predetermine tool performance on each job. For more output per month and lower production costs, put this 3-step plan to work now.

1. Your Real Key to More Output From Tools

By knowing *in advance* what performance to expect from your tools you can reduce idle machine and press time. And the Carpenter Matched Set Method gives you a way to do just that. It's a sure-fire way to get tools that need fewer regrindings and replacements. This 167-page Manual points the way to the tool steel properties you need—greater wear resistance, more toughness, etc. With its 80-page Tool Index and Steel Selector you can quickly find the best starting place when you have a new tool to make. For easier tool steel selection and better results on the job, send for this Carpenter Manual. Just drop us a note on your company letterhead.

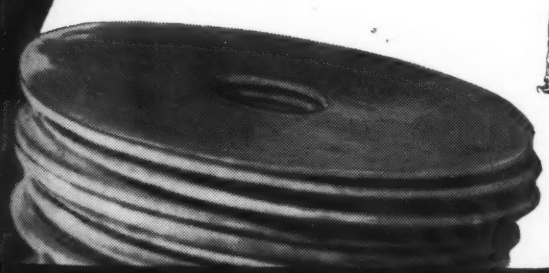
2. Lick Hardening Trouble At the Start

Proper heat treatment is the second step to better tools that increase production. To get the heat treating results you want, use the "Matched Tool Steel Manual". It contains the most complete heat treating information available in printed form. And as a special help to your heat treaters, we have prepared a handy slide chart that condenses the basic heat treating information and puts it in easy-to-use form. Drop us a line and let us know how many Carpenter heat treating slide charts you will need.

3. Keep Records of Tool Output Per Grind

Follow each tool set-up on the job. Check the reasons for any premature failure or too frequent regrinding. You'll soon spot new ways to make your tools save production time—and money. And when you want personal help with a tooling problem call on your nearby Carpenter representative. He really knows tool steel and can help you reduce costs all along the line.

THE CARPENTER STEEL COMPANY
105 W. Bern St., Reading, Pa.



Carpenter MATCHED TOOL STEELS

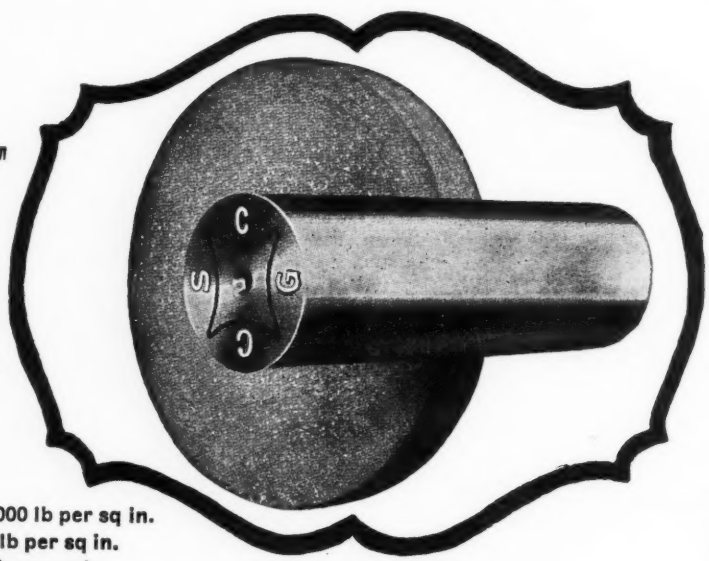
ESTABLISHED 1845

100 Years of Experience Produces

CUMBERLAND GROUND SHAFTS

Concentric • Straight • Accurate!

RESULTS — Speed Assembly • Save Labor Cost • Eliminate Tie-up!



DIAMETERS 1-1/8" to 8" INCLUSIVE

•

MINIMUM ELASTIC LIMIT

Cumberland Brand—30,000 lb per sq in.
Potomac Brand—45,000 lb per sq in.
Cumsco Brand—55,000 lb per sq in.

SHAFTS MACHINED TO BLUEPRINTS

•

MAXIMUM LENGTHS MANUFACTURED

Year 1845—up to 16 feet
Year 1886—up to 25 feet
Year 1945—up to 70 feet

Coast to Coast Service by

Baltimore, Maryland—Addison Clarke & Bro.
Boston, Mass.—Hawkridge Brothers Company
Boston, Mass.—Brown-Wales Company
Bridgeport, Conn.—Hunter & Havens, Inc.
Buffalo, New York—Jos. T. Ryerson & Son, Inc.
Chicago, Ill.—Central Steel & Wire Co.
Cincinnati, Ohio—Jos. T. Ryerson & Son, Inc.
Cleveland, Ohio—The Bissett Steel Company
Dayton, Ohio—Central Steel & Wire Co.
Detroit, Michigan—Central Steel & Wire Co.
Fort Worth, Texas—C. A. Fischer
Hartford, Conn.—Hunter & Havens, Inc.
Indianapolis, Ind.—Tanner & Company
Jersey City, N. J.—Jos. T. Ryerson & Son, Inc.
Kansas City, Mo.—F. H. Turner
Lakeland, Fla.—Mine & Mill Supply Co.
Los Angeles, Calif.—Link-Belt Co., Pacific Div.
Louisville, Ky.—Neill-LaVielle Supply Co.
Martinsburg, W. Va.—W. H. Heiston & Son
Montreal, Can.—Drummond, McCall & Co., Ltd.
New York City, N. Y.—Bright Steel Corp.
Oakland, Calif.—Link-Belt Co., Pacific Div.
Philadelphia, Pa.—Charles Bond Company
Philadelphia, Pa.—Horace T. Potts Co.
Pittsburgh, Pa.—McKee-Oliver, Inc.
Portland, Maine—W. L. Blake & Company
Portland, Oregon—Link-Belt Co., Pacific Div.
Providence, R. I.—Congdon & Carpenter Co.
Quebec, Canada—H. Duchene
San Francisco, Calif.—Link-Belt Co., Pacific Div.
Seattle, Wash.—Link-Belt Co., Pacific Div.
Spokane, Wash.—Link-Belt Co., Pacific Div.
Toronto, Canada—Drummond, McCall & Co., Ltd.
Worcester, Mass.—Pratt & Inman

CUMBERLAND STEEL COMPANY CUMBERLAND, MARYLAND, U. S. A.
ESTABLISHED 1845 INCORPORATED 1892

• Yes, sir — they've done some mighty tricky things with magnesium! . . . but that's no reason to shy away from it on your "every day" jobs. If it's lightweight, high strength and unusual stamina you're after, consider Magnesium Sand Castings. Superior engineers will be glad to help you use Magnesium Sand Castings to best advantage.

Literature on designing, machining, and finishing magnesium castings—on request.

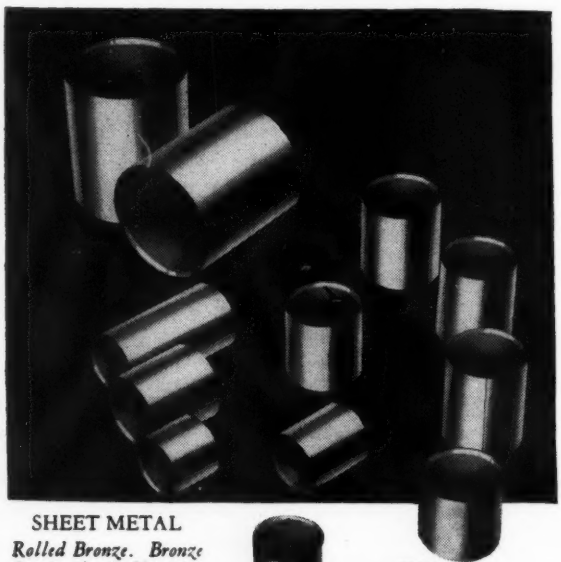
Superior Magnesium Castings

DIVISION OF SUPERIOR BEARING BRONZE CO., INC. • 149 BANKER STREET • BROOKLYN 22, N. Y.

MAGNESIUM SAND & DIE CASTINGS TO MEET U. S. ARMY & NAVY SPECIFICATIONS

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS

No Reconversion *problem*



SHEET METAL
Rolled Bronze. Bronze On Steel. Babbitt On Steel.

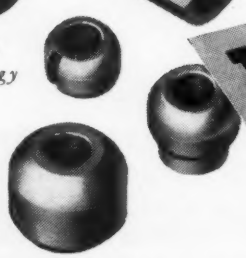
Johnson Bronze is ready to supply your peace time bearing needs. We had no reconversion problem. The change from war production to peace time operation was made *over night.* And we have much more to offer Industrial America. Our facilities have been increased . . . our equipment is the finest obtainable . . . we have added greatly to our skill and experience . . . and we are the *only* bearing manufacturer that makes *every* type of Sleeve Bearing. Why not consult with Johnson Bronze now? Let us help you solve your bearing problems . . . help you get an early start for your post-war market.

JOHNSON BRONZE CO.
520 S. MILL ST. NEW CASTLE, PA.

CAST BRONZE
Plain or Graphited

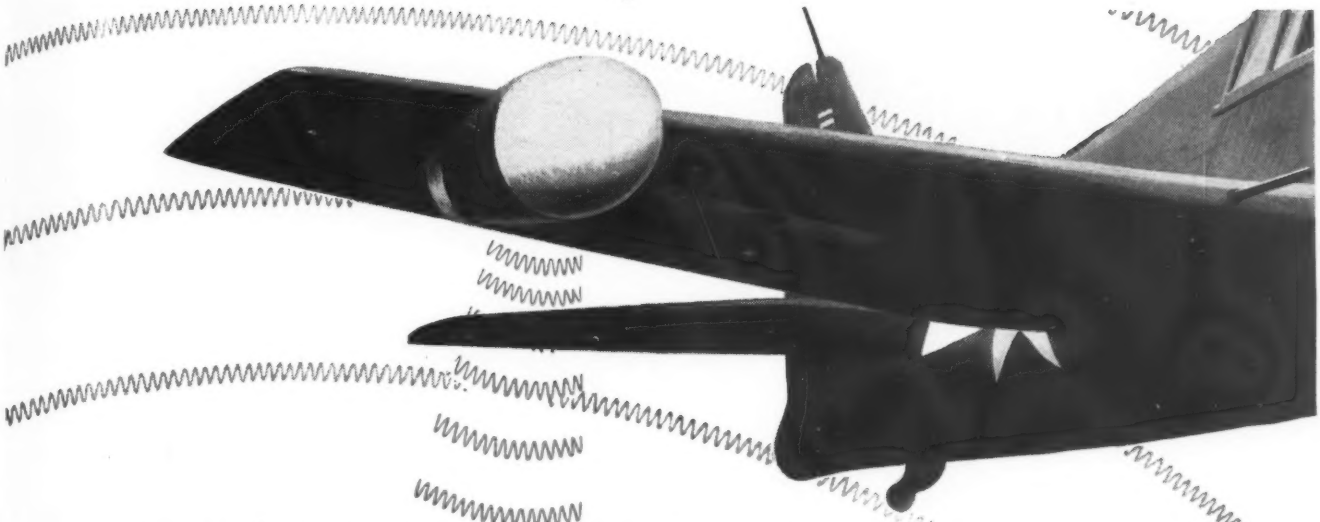
BABBITT LINED
Bronze or Steel Backing

LEDALOYL
Power Metallurgy



JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS

BRANCHES IN 18 INDUSTRIAL CENTERS



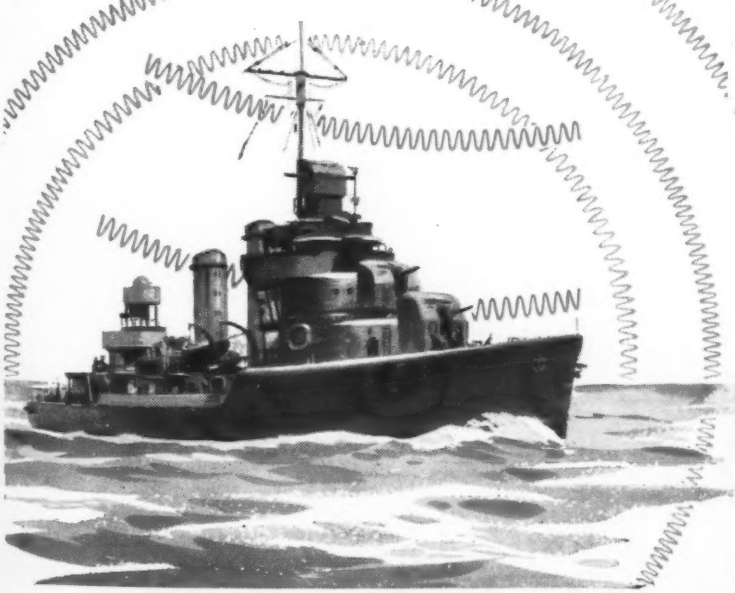
PRESENTING THE CASE FOR RADAR

AS THE STORY of radar unfolds, the nation becomes increasingly aware of the extreme importance of this one-time "secret weapon." And behind *that* story is another—about radically new types of housings that had to be developed before radar could perform its vital functions on land, at sea, and in the air . . . housings called radomes.* Certain types, such as the radome illustrated, were produced from woven glass cloth and BAKELITE laminating resins.

Manufacturers, designers, and engineers will be interested in the exceptionally exacting requirements that were met: low power factor and low dielectric constant at high radio frequencies; high tensile, flexural, and compressive strengths; and extreme weatherability. Still other advantages of this new and superior electrical insulating plastic included good color stability and resistance to marine growths. Productionwise, these laminated radomes were formed at low fabricating pressures, in comparatively inexpensive molds. They demonstrate the practicality and economy of forming large, intricate shapes by this laminating-molding technique at pressures frequently as low as one pound per square inch

Write Department 50 for further information on BAKELITE resins for high-, low-, and contact-pressure laminating, and the names of the suppliers of the finished laminates.

*Radome illustrated through courtesy of Andover-Kent Aviation Corp.



TRADE (B) MARK

BAKELITE CORPORATION

Unit of

Union Carbide and Carbon Corporation

UCC

30 EAST 42ND STREET, NEW YORK 17, N.Y.

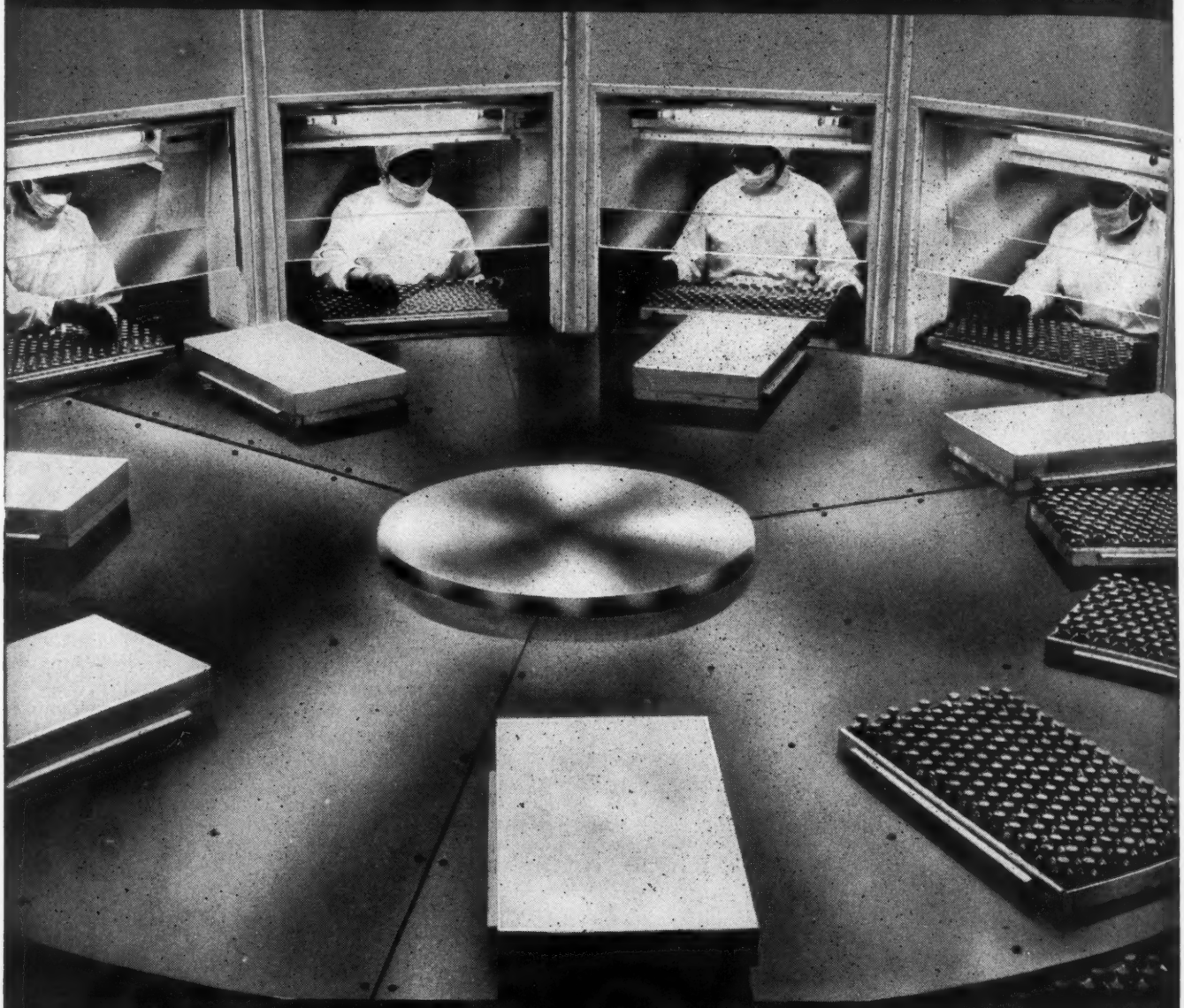
BAKELITE

TRADE-MARK

LAMINATING PLASTICS

STAINLESS STEELS

Most versatile of modern metals... their unique combinations of properties merit your consideration in designing for the future.



"Photograph courtesy Chas. Pfizer & Co., Inc."

Packaging the miracle drug... penicillin... calls for completely sterile conditions. Here the table must be the very acme of aseptic cleanliness... easy to clean and keep clean. Hence, it's chromium-Nickel stainless steel.

• • •

International Nickel are miners, smelters and refiners of Nickel, an important ingredient of the stainless steels, but do not produce stainless steels. If interested, please communicate with your established sources of supply for stainless steels.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.

IT TAKES ALL 3

– for complete Tool and Die Steel Service

1

Outstanding Mill Quality

2

Strategically Located Warehouses { DETROIT, CHICAGO, TOLEDO CLEVELAND, PHILADELPHIA LATROBE, HARTFORD

3

Dependable Metallurgical Service { Latrobe service men are always glad to render personal counsel on your particular problems.

LATROBE

LESCO

- **High Speed Steels**
- **Die Steels**
- **Tool Steels**
- **Stainless**
- **Red Arrow**
  Cast Alloy for Metal-Cutting Tools.
  Welding Rod for Hard Facing.

Latrobe ELECTRIC STEEL COMPANY

S-6 MAIN OFFICES *and* PLANT •• LATROBE • PENNSYLVANIA

PAINT ADHESION PROBLEMS

SOLVED BY THIS NEW OAKITE DEVELOPMENT

OAKITE CRYSCOAT PROCESS

TRADE MARK REG. U.S. PAT. OFF.

A low-cost cleaning and chemical conditioning treatment for ferrous metal parts and surfaces that inhibits rust and successfully provides the essential surface grippage for tenacious adhesion of organic finishes.

Extensively used on many types of war matériel, this specially designed wartime Oakite process has a wide application on an almost unlimited variety of iron and steel peace-time products to which paint and similar finishes are applied. Because it so effectively helps to keep production costs low, ask us to send you the interesting details on how you can inexpensively CrysCoat your product and solve the problem of paint adhesion.

FREE SERVICE REPORT GIVES YOU DETAILS

This 4-page Service Report describes how Oakite CrysCoat No. 86, an integral part of the Oakite CrysCoat Process, in ONE time-saving operation (1) removes light oils, grease, shop dirt and other foreign matter; (2) inhibits surfaces against rusting while parts are being held for painting; (3) imparts a microscopic crystalline coating to ferrous surfaces that assures TENACIOUS GRIPPAGE of paint or other organic finishes.

Oakite CrysCoat No. 86 is a NEW, acid-type detergent, SAFE to product itself and SAFE to washing equipment in which it is used. If you are experiencing trouble and are getting rejects due to paint adhesion failure, this Oakite Service Report will give you a war-tested, successful answer to this problem. Send for your FREE copy today!

OAKITE PRODUCTS, INC., 26 Thames St., New York 6, N. Y.

Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE CLEANING

MATERIALS . . METHODS . . . SERVICE — FOR EVERY CLEANING REQUIREMENT

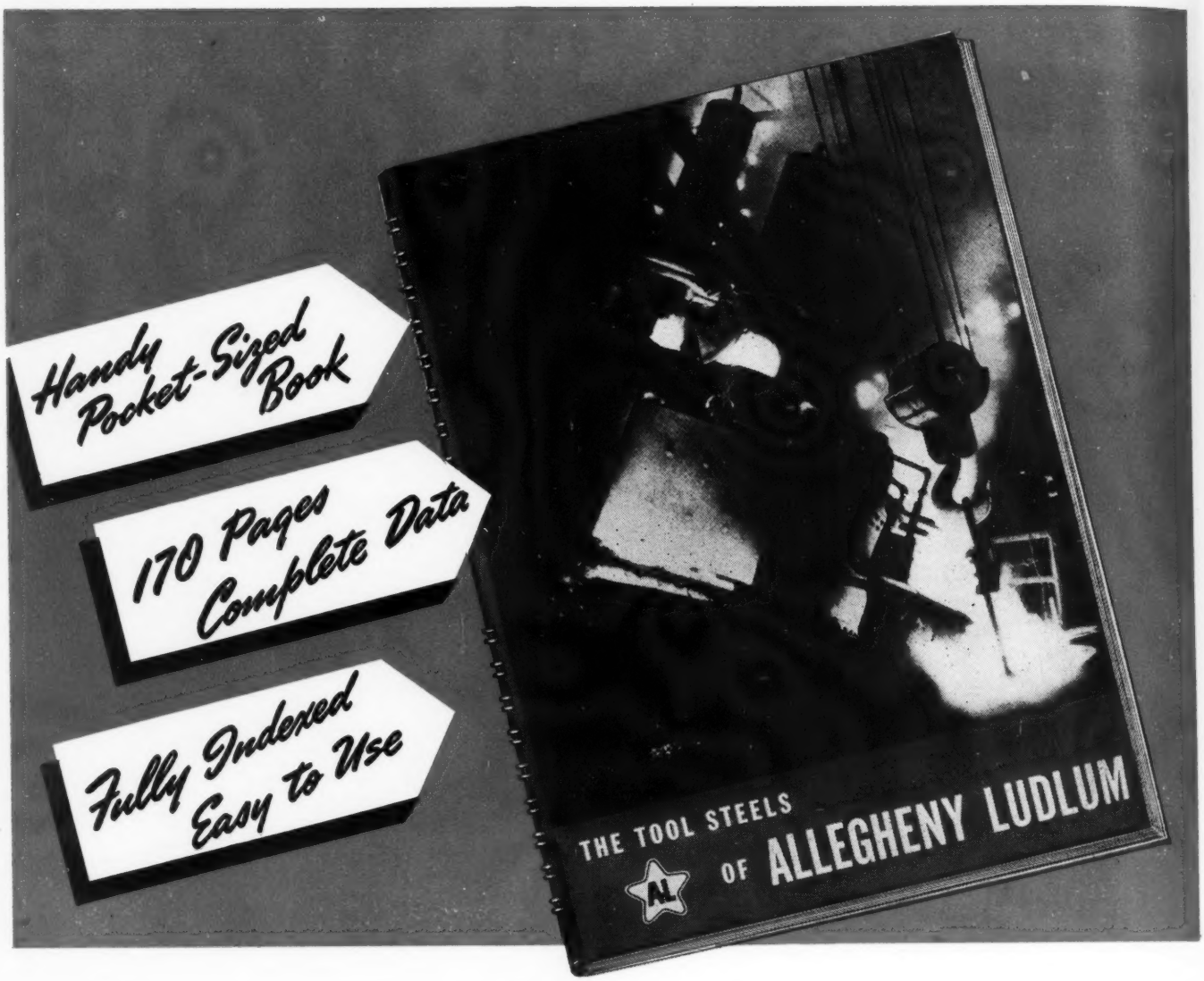
• Yes, sir — they've done some mighty tricky things with magnesium! . . . but that's no reason to shy away from it on your "every day" jobs. If it's lightweight, high strength and unusual stamina you're after, consider Magnesium Die Castings. Superior engineers will be glad to help you use Magnesium Die Castings to best advantage.

Literature on designing, machining, and finishing magnesium castings—on request.

Superior Magnesium Castings

DIVISION OF SUPERIOR BEARING BRONZE CO., INC. • 149 BANKER STREET • BROOKLYN 22, N. Y.

MAGNESIUM SAND & DIE CASTINGS TO MEET U. S. ARMY & NAVY SPECIFICATIONS



THE ANSWERS TO ALL YOUR NEEDS IN

TOOL AND DIE STEELS . . .

- ★ HIGH SPEED STEELS
- ★ HOT WORK STEELS
- ★ SHOCK RESISTING STEELS
- ★ COLD WORK STEELS
- ★ CARBON STEELS
- ★ HIGH SPEED AND TOOL STEEL FORGINGS
- ★ CAST-TO-SHAPE TOOL STEELS
- ★ COMPOSITE DIE STEELS

TO MEET ANY REQUIREMENTS

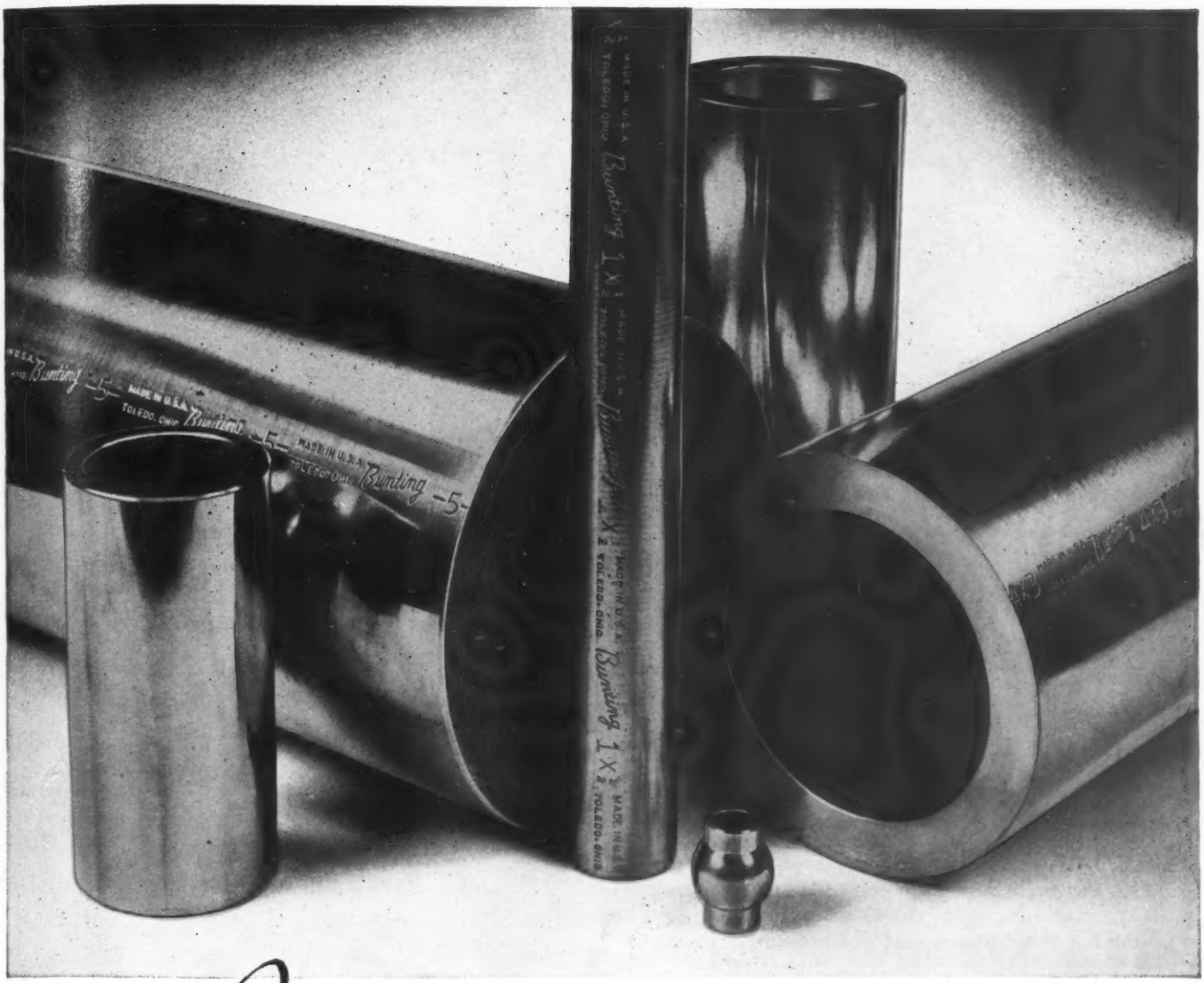
TODAY—and for a long time to come—the premium on production cost-saving is greater than ever before. Match up each one of your machine operations with the tool or die steel that will do the job faster, better, or with less "down" time. This new booklet gives you complete information on the exceptionally large family of Allegheny Ludlum Tool Steels—invaluable data on properties, uses, selection and handling that every production man should have.

write for your copy . . . **Address Dept. M-36**

ALLEGHENY LUDLUM

STEEL CORPORATION · General Offices, Brackenridge, Pa.

Pioneer in Specialloy Steels

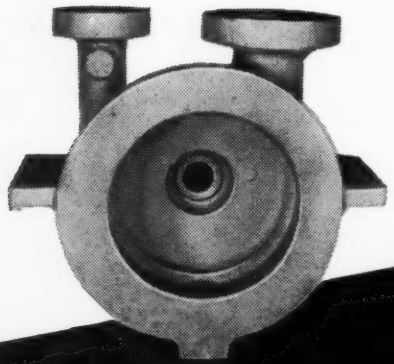


Recognized advantages of Bunting Cast Bronze Bearings and Bars are maintained and increased by advanced metallurgy and manufacturing processes. These finer bronze bearings and bars are available in many different stock sizes from Authorized Bunting Distributors everywhere. Ask your Distributor for Catalog giving complete listing. For Special bearings, to your own dimensions and alloys, write our factory direct. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in principal cities.

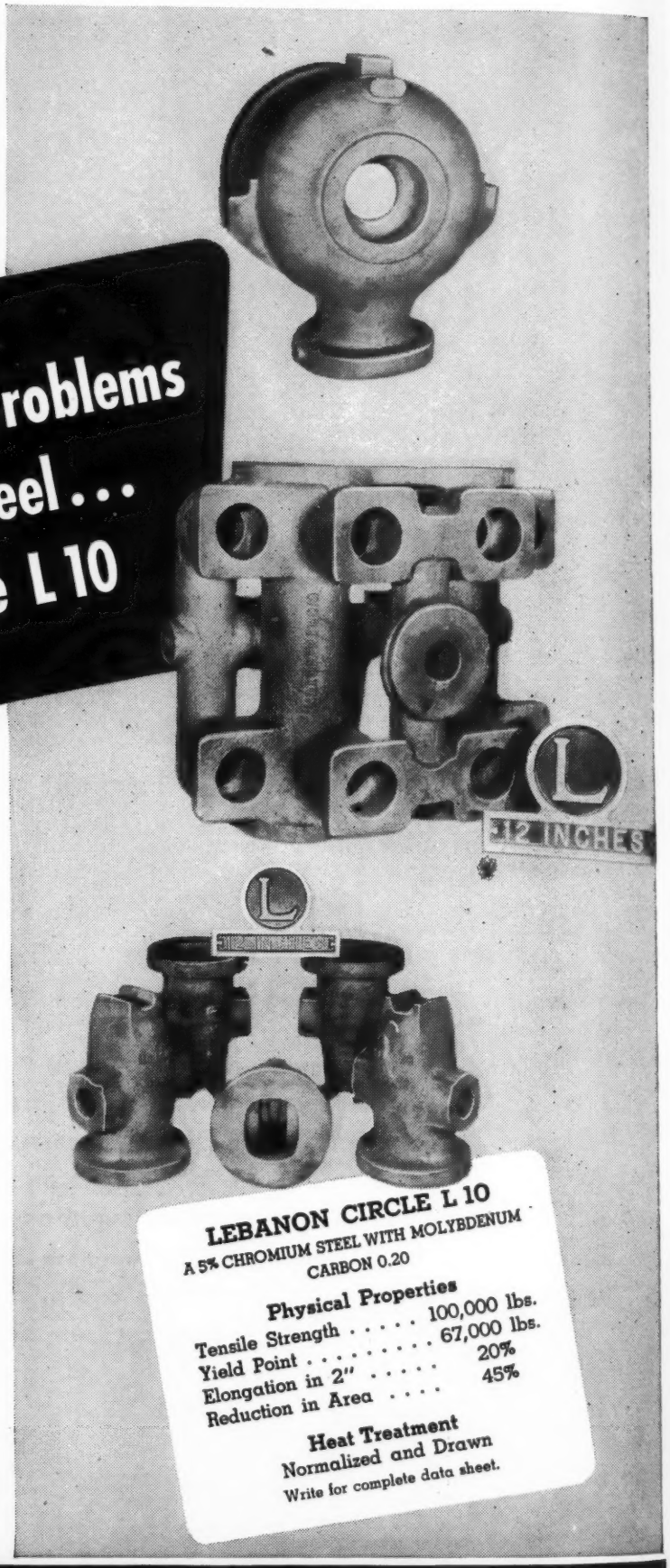
30

Bunting

BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS



Solve 5 Castings Problems with 1 Alloy Steel... Lebanon Circle L 10



WHEN service conditions call for castings with (1) high yield point (2) low creep (3) remarkable strength (4) ability to withstand high pressures and (5) resistance to corrosion—do what leaders in the oil refining industry have done for years! Specify castings of Lebanon Circle Ⓛ 10.

General physical properties of this alloy steel are outstanding . . . weldability is satisfactory . . . and it gives excellent service at elevated temperatures.

For years, Circle Ⓛ 10 has been a standby for high pressure and other applications. It has proved its ability to withstand the corrosive action of hydrogen sulphide and other sulphur gases at temperatures up to 1100 F.

Lebanon foundry engineers and metallurgists are prepared to discuss your casting needs now. Write and tell us your requirements.

LEBANON STEEL FOUNDRY LEBANON, PA.

"In The Lebanon Valley"

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

Castings shown were cast from Circle Ⓛ 10 for hot oil refinery service. *Top left,* centrifugal pump casing; *top right,* suction head for oil refinery pump; *center right,* liquid cylinder for duplex piston pump; *lower right,* bodies for high pressure valves.

LEBANON CIRCLE L 10

A 5% CHROMIUM STEEL WITH MOLYBDENUM

CARBON 0.20

Physical Properties

Tensile Strength	100,000 lbs.
Yield Point	67,000 lbs.
Elongation in 2"	20%
Reduction in Area	45%

Heat Treatment

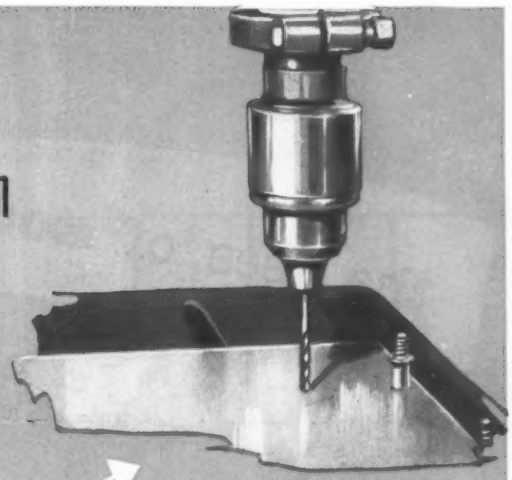
Normalized and Drawn

Write for complete data sheet.

Lebanon ALLOY AND STEEL Castings

How magnesium is speeding production

because it's easy to work!



Many a firm goes to magnesium for its unique *lightness* . . . and then chalks up additional boosts in production because it's so *easy to work*. Modern plants that use magnesium find it saves time, labor, and tools through this exceptional workability.

Magnesium is easy to saw, with band and circular saws and also hand and power hack saws. It permits larger cuts per tooth than other structural metals. And it can be worked faster and easier than most metals by hand tools—chipping tools, drills, burrs, chisels, planes, and portable milling cutters.

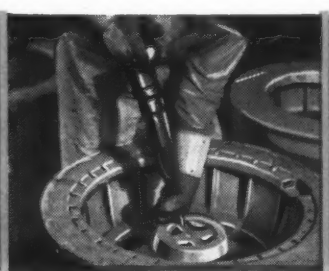
As the first step toward applying these important economies to your own product, you need only get in touch with the nearest Dow office. Technical consultants are at your service.

Ready . . . to make products move!

MAGNESIUM

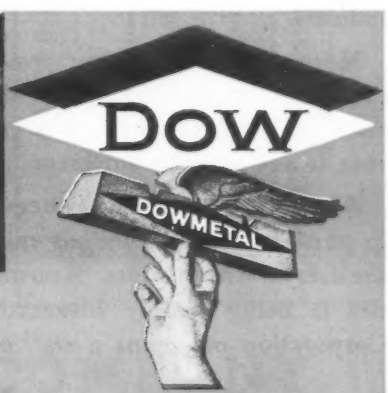
LIGHTEST OF ALL STRUCTURAL METALS

Magnesium forming methods are similar to those used with other metals, except that magnesium is usually formed hot.



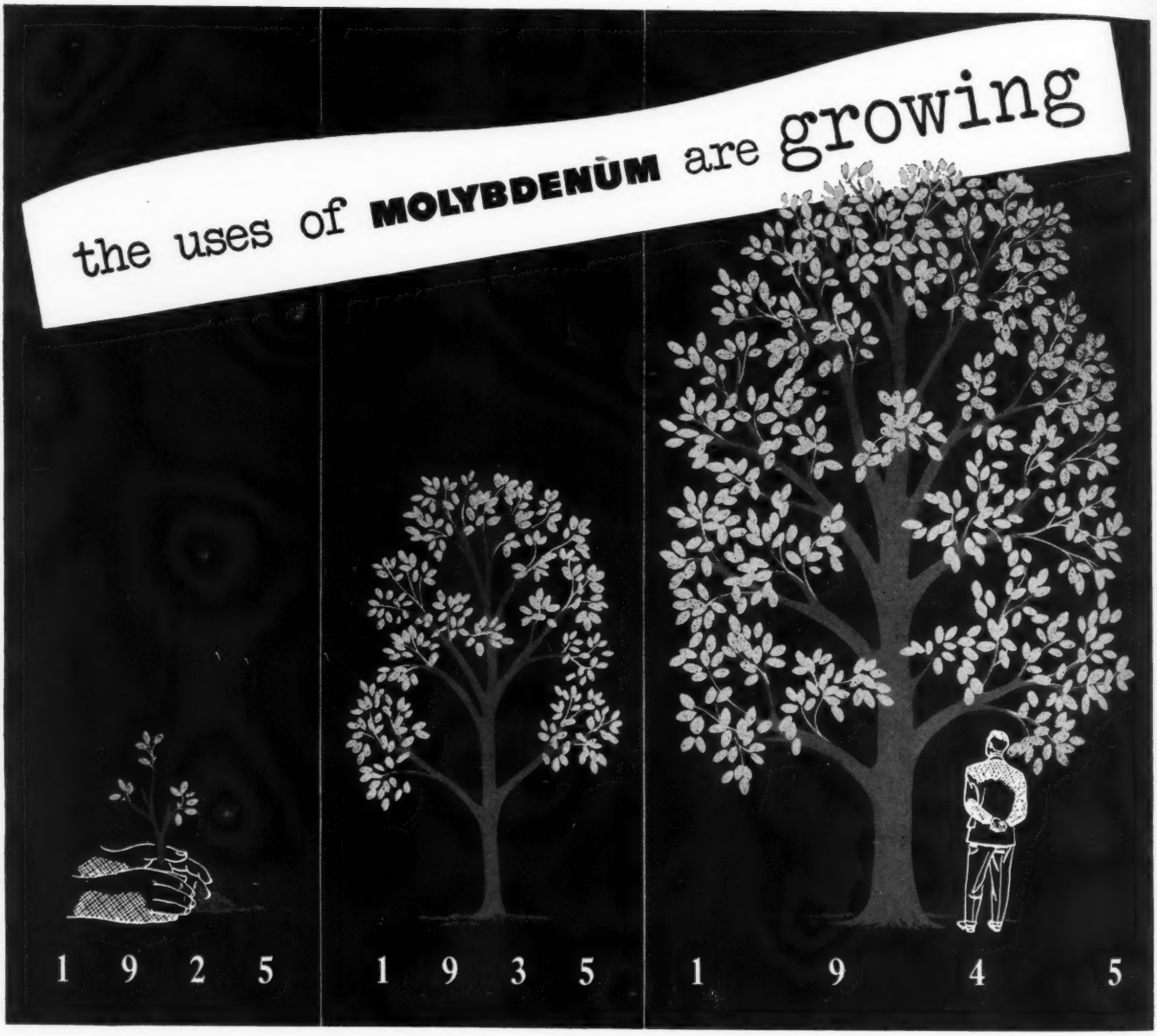
Excellent machinability of magnesium speeds work with hand tools, such as the chipping operation on this magnesium casting.

Sawing magnesium, with low cutting pressures, requires only one-tenth the power that is needed for sawing steel.



MAGNESIUM DIVISION • THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

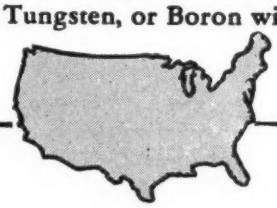


"All types of work will be included, but special emphasis will be on those using metals."

So reads a paragraph in a recent Government report. It relates to modernization of commercial buildings, but might apply as well to various departments of industry.

More use of metals. Better metals, of more specialized properties, for particular uses. More precise consideration of serviceability with a view to lower overall cost, in any given employment . . .

All this active search for better utilization of materials in post-war manufacture has enlarged and diversified the uses of Molybdenum. Knowledge of the possibilities is being rapidly advanced. The Molybdenum Corporation maintains a staff of technicians whose advice is often found helpful, and sends out informative literature on request. Inquiries on any proposed use of Molybdenum, Tungsten, or Boron will be welcomed.



AMERICAN Production, American Distribution, American Control—Completely Integrated.
Offices: Pittsburgh, New York, Chicago, Detroit, Los Angeles, San Francisco, Seattle.
Sales Representatives: Edgar L. Fink, Detroit; H. C. Donaldson & Co., Los Angeles, San Francisco, Seattle.
Works: Washington, Pa.; York, Pa.
Mines: Questa, N. M.; Yucca, Ariz.; Urad, Colo.

MOLYBDENUM CORPORATION OF AMERICA
GRANT BUILDING PITTSBURGH, PA.

MCA

TOOL STEEL DATA

Revised Data for Water Hardening Tool Steels including types, analyses, uses, hardening characteristics and temperature ranges

DECEMBER, 1945

WATER HARDENING TOOL STEEL CHARACTERISTICS

TYPE	GRADE	ANALYSIS	USES Water Hardening Tool Steel for Cold Work Dies and Tools Requiring:	HARDENING CHARACTERISTICS		
				HARDENING TEMPERATURES	QUENCH	RC
Carbon Alloy Treated	SPECIAL	C * Mn .25 Si, .25 Cr .15 V .04	• Highest Quality • Keen Cutting • High Surface Hardness with a Tough Core	Range: 1420° F. to 1530° F. Cutting and Shearing Tools: 1420° F. to 1450° F. Parts Subject to Steady Pressure: 1440° F. to 1480° F. Dies Subject to Severe Blows: 1470° F. to 1530° F.	Water or Brine	64-66
Carbon	EXTRA	C * Mn .25 Si .20	• High Hardness of Medium Depth • Good Wear Resistance • Shock Resistance	Range: 1425° F. to 1550° F. Cutting and Shearing Tools: 1425° F. to 1450° F. Forming; Steady Pressure Tools: 1440° F. to 1490° F. Dies Subject to Heavy Blows: 1500° F. to 1550° F.	Water or Brine	64-66
Carbon Vanadium	VANADIUM EXTRA	C .95 Mn .30 Si .25 V .20	• Increased Wear Resistance • Added Toughness and Fatigue Resistance	Range: 1450° F. to 1500° F.	Water or Brine	64-66
Carbon Chrome	WATERDIE	C 1.00 Mn .35 Si .25 Cr. .55	• Uniform Strong Case in Large Sections • High Wear Resistance	Range: 1500° F. to 1525° F.	Water or Brine	64-66
Carbon Manganese	EXTRA HEADER DIE	C .95 Mn .35 Si .25	• Uniform Deep Hardening in tools such as Header Dies	Range: 1475° F. to 1550° F.	Water or Brine	64-66
QUENCHING: A brine quench 60° to 80° F. is recommended. Remove tools from the quench at approximately 300° F. and cool in air to about 125° F. and temper immediately.						
TEMPERING: These are usually tempered from 300° F. to 600° F. As the temperature increases, hardness decreases and toughness increases.						
NOTE: These steels meet rigid Hot Etch and Hardenability Standards. Water hardening steels harden with a depth of case of 1/8" to 1/4" depending on Mass, Hardening Temperature and Hardenability. *Available in 3 carbon ranges: approx. C 1.15; approx. C 1.05; and approx. C .95.						

COLUMBIA TOOL STEEL COMPANY

MAIN OFFICE AND WORKS—CHICAGO HEIGHTS, ILLINOIS

Branches and Warehouses . . . CHICAGO • CINCINNATI • CLEVELAND • DETROIT • MILWAUKEE

117 YEARS OF "KNOW-HOW"

Two examples of the versatility that can solve your casting problems

The large copper casting on spider for a welding machine shown above, and the alloyed iron base for a machine tool shown at right are both highly intricate, highly specialized jobs . . . but they're all in the day's work for Cramp. Here you'll find one of the largest and best equipped pattern shops in the country . . . foundry facilities that can handle either bronze or iron castings from ounces to over 100,000 pounds in weight . . . and experience and traditions gained in 117 years of activity—*all waiting to serve you.* Ask for the new Cramp Catalog, for detailed descriptions of facilities and products. The Baldwin Locomotive Works, Cramp Brass & Iron Foundries Division, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, New York, Boston, Chicago, St. Louis, Washington, San Francisco, Detroit, Cleveland, Houston, Pittsburgh.

BALDWIN
CRAMP
FERROUS & NON-FERROUS CASTINGS

BLW THE BALDWIN GROUP

IT'S NEW! IT'S BETTER! IT'S DIFFERENT!

BETHLEHEM Black Giant TOOL STEEL

(GRAPHITIC)

Here's news of smashing interest to users of tool steels. News that can be headlined in three words: Bethlehem Black Giant.

Many months of chemical, metallurgical, experimental, and testing work preceded the announcement of Black Giant Tool Steel; but now the facts are established. Facts like these:

- Black Giant has superlative machining qualities.
- An oil-hardening tool steel, it responds readily to heat-treatment.
- It has much greater depth of hardness than ordinary graphitic steels.
- It has better non-deforming properties.
- Its self-lubricating qualities mean lower coefficient of friction; longer life in tools requiring high resistance to abrasive wear.

These are but a few of Black Giant's many advantages. There are others that you will want to hear about. For further details, check with the nearest Bethlehem office or distributor. *Black Giant warrants an immediate investigation.*

TYPICAL ANALYSIS

C	*Mn*	*Si*	*Cr*	*W*
1.40	0.90	2.20	0.45	0.50

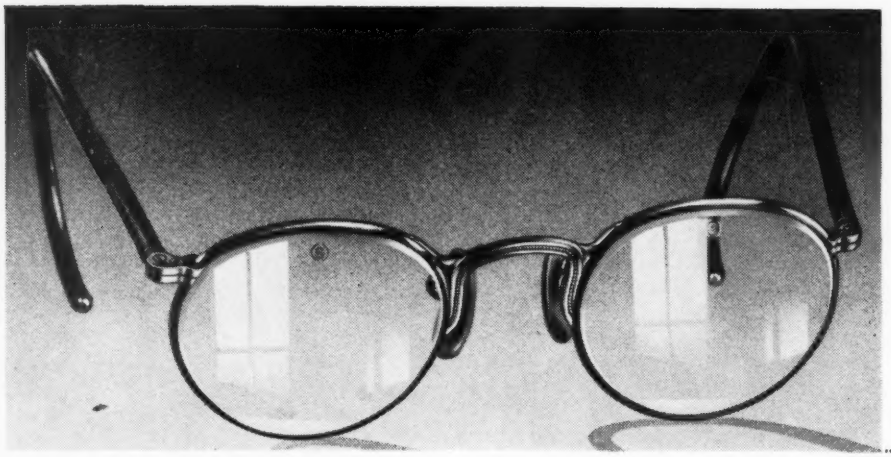
TYPICAL USES

Machined dies; plug or ring gages; bushings; spindles; mandrels; seaming rolls; narrow strip or foil rolls; bending, drawing, cupping, and stamping dies; deep-drawing and forming operations; and other uses requiring high resistance to wear and abrasion.

Black Giant does not replace the standard oil-hardening tool steel (Bethlehem's BTR). It will, however, definitely complement the use of BTR in such special applications as those listed above.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY
Bethlehem, Pa.

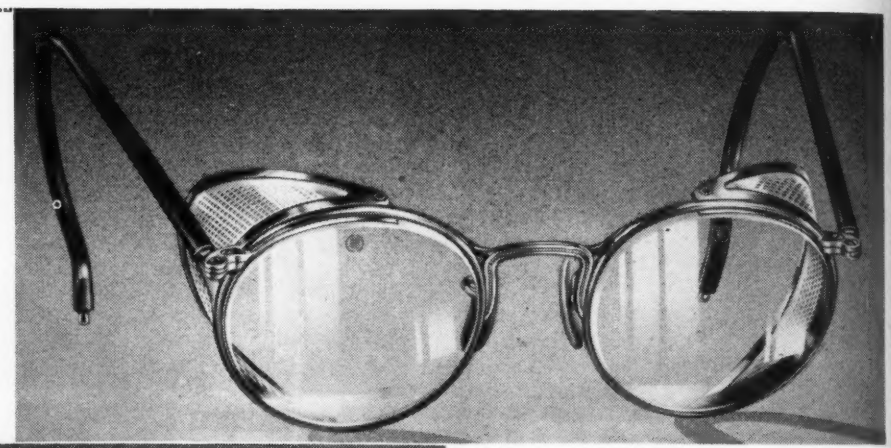


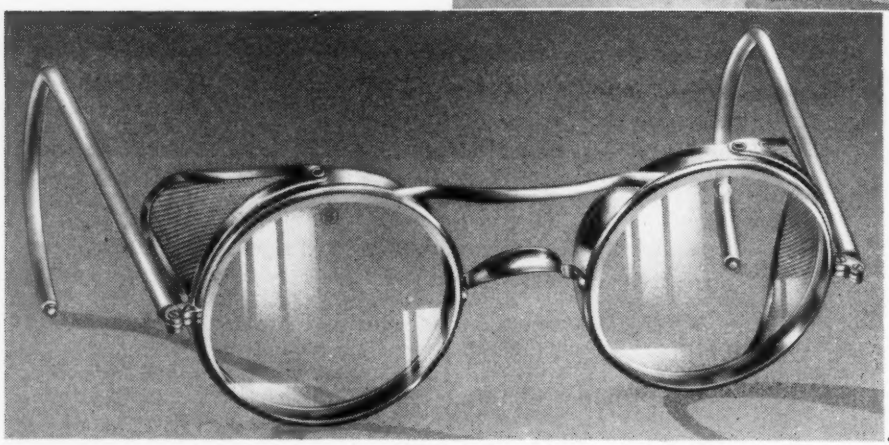
AO Ful-Vue Safety Goggles, with Super Armorplate lenses, afford efficient eye-protection with the greatest amount of all-angle visibility, comfort and good appearance.

AO SAFETY GOGGLES

Safeguard the Eyes of Industry

AO Ful-Vue Safety Goggles with wire mesh side shields afford extra protection against particles striking from sides.

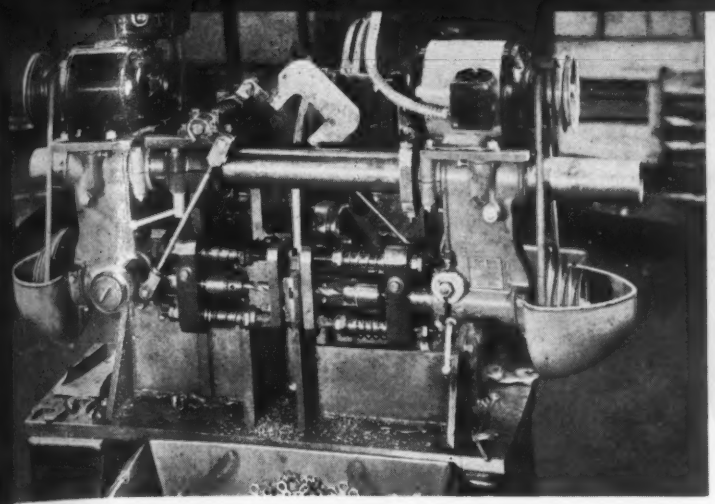




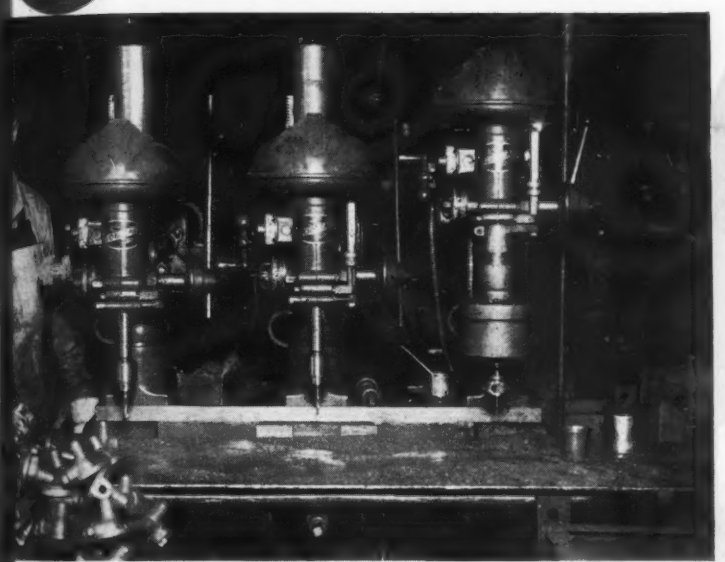
AO Spectacle Goggles—with rigid bridge and reinforcing bar—are comfortable and sturdy... give full protection against particles striking from front or sides.

AO offers a type of safety goggle for every eye-protection requirement. Your nearest AO Representative will be glad to advise you regarding selections.

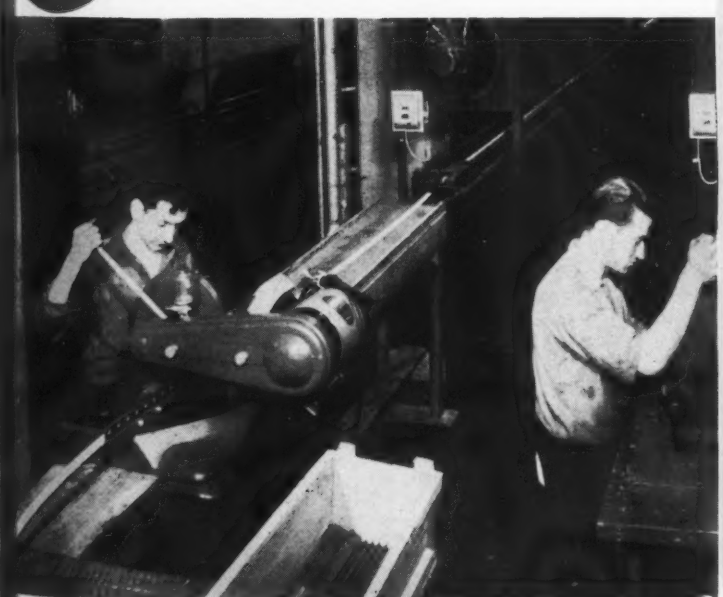
American Optical
COMPANY
SOUTHBRIDGE, MASSACHUSETTS
Safety Division



1 Save the extra cost of special machines, by building your own high-production, specific-purpose units out of standard Delta components.



2 Make old machines useful — economically — by replacing worn-out assemblies with stock-model Delta components.



3 Utilize the portability and compactness of Delta-Milwaukee Machine Tools, to revise or supplement production-line layouts for increased man-hour output.

money-saving ideas on RETOOLING ...with flexible, low-cost

Delta
MILWAUKEE
REG. U.S. PAT. OFF.

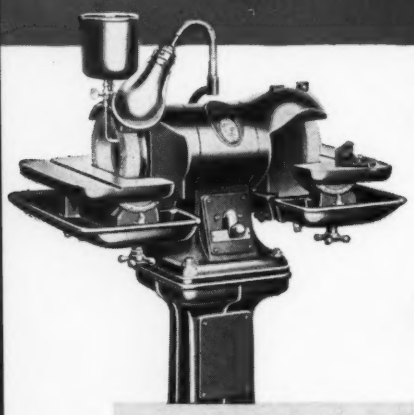
Machine Tools

TURN THE PAGE

The flexibility and low cost of Delta-Milwaukee Machine Tools help you cut your investment risk

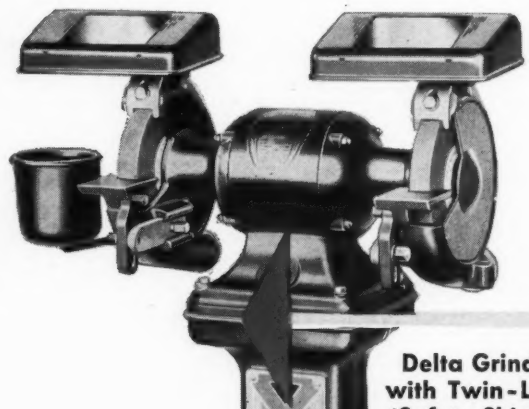
Delta
MILWAUKEE
REG. U. S. PAT. OFF.

Machine Tools



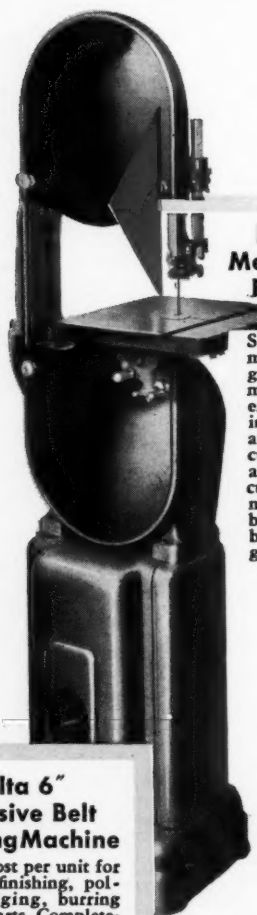
Delta Carbide Tool Grinder

Combined with the Delta Standard tool grinder for hogging down the shank steel, this vibrationless unit gives you a perfect working combination for sharpening tungsten carbide tools, with a remarkably small initial investment.



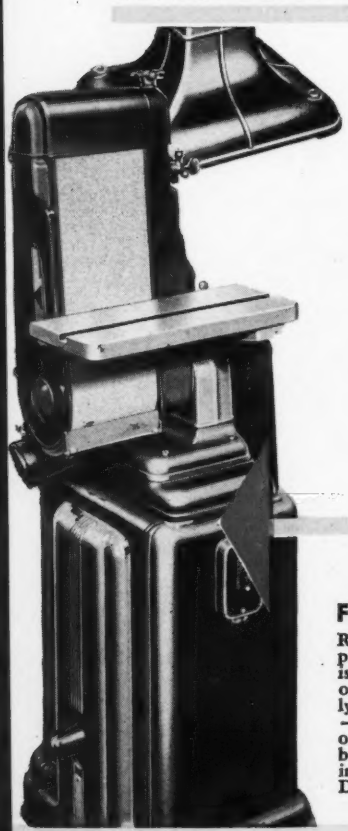
Delta Grinder with Twin-Lite* Safety Shields

Safety glass shields are built right in! Both wheels are flooded with light, to assist accurate tool grinding. Easily-adjustable, machined tool rests. Balanced wheels.



Delta 14" Metal-Cutting Band Saw

Saves time and money on many general tool and machine shop operations — sawing off tool, die, and fixture stock; cutting templates and similar tools; cutting almost any material from carbon steel to asbestos. Fully safeguarded.



Delta 6" Abrasive Belt Finishing Machine

Reduces cost per unit for precision finishing, polishing, edging, burring of small parts. Completely flexible in operation — can be set vertically or horizontally. Has lubricated-for-life ball bearings and other famous Delta quality features.

Delta Super-Hi-Speed Drill Press

A low-cost 14" machine for precision small-hole drilling of plastics and light non-ferrous metals. Interchangeable with standard Delta 14" model on regular 14" drill press column. Speed range of 12000 . . . 8100 . . . 5000 R.P.M. Specially-selected Jacobs chuck with drill capacity of from .025" to ¼". Spindle travel of 2¼". Head, complete with 60-cycle motor, available separately.

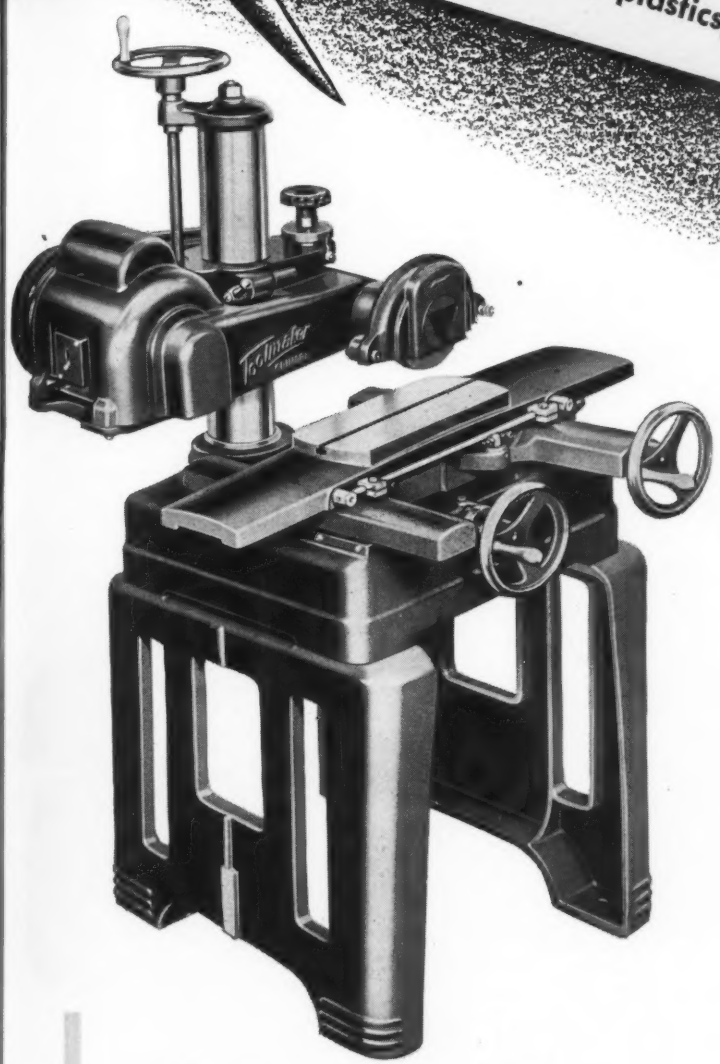
Write for free, descriptive bulletin.

Consult your DELTA-MILWAUKEE distributor

War production experience suggests economies you can enjoy in all these departments – and many more

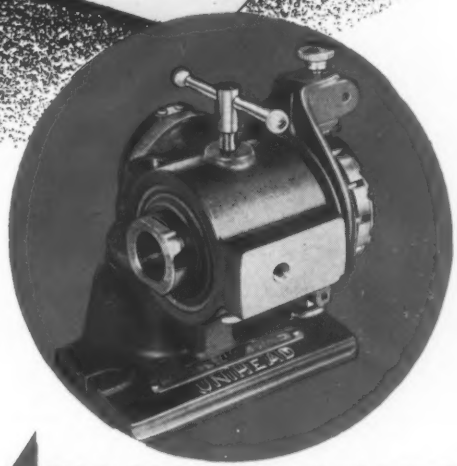
- ☑ Parts Production
- ☑ Assembly
- ☑ Tool Shop
- ☑ Maintenance Shop
- ☑ Foundry
- ☑ Pattern Shop
- ☑ Shipping Department
- ☑ Research or Experimental

. . . on a wide variety of applications in working metals, plastics, wood.



Delta Toolmaker* Surface Grinder

Low cost and portability permit this husky, big-capacity grinder to be quickly swung into any spot to free machines costing many times as much. Designed for ease and speed of surface grinding, tool sharpening, and any grinding operations within its range. Convenient controls . . . wide graduations on micrometer for close settings . . . unique wheel-adapter that saves time on truing-up operations . . . many other advantages that help assure you of creditable performance. 7″ x ½″ wheel; 1¼″ bore. Table surface 5¾″ x 13″.



With the Unihead,* and the tool and cutter grinder attachment, this machine becomes the latest development in Tool and Cutter grinding. Simple, accurate, very low in cost. Delta construction features assure perfect alignment and freedom from play. Substantially built and machined to very close tolerances.

With the Univise,* the first truly universal vise for grinding, drilling, and milling — and the coolant attachment — this machine serves as a dependable, accurate Chip-Breaker Grinder for grinding the chip-breaker groove on carbide-tipped tools. Holds the tool at any conceivable angle — accurately reset at a moment's notice.

*Trade Mark Reg. U.S. Pat. Off.

regarding priorities and deliveries

TURN THE PAGE

FREE 76-page Blue Book

helps you visualize the almost unlimited money-saving applications of

Delta-Milwaukee Machine Tools

Here is a stimulating book that pictures and describes a wide range of applications using Delta-Milwaukee Machine Tools — actual, detailed case histories which give your production men a running start on your own special problems in working metals, plastics, or wood.

It may suggest — as it has in many cases — ways in which you can adopt this modern tooling practice, to save time and money.

This practical approach to the uncertainties ahead holds your capital investment to a minimum. Delta cost savings are due to modern production methods applied to a large volume of standard models—not to short-cuts in quality.

Also available is a catalog of flexible, low-cost Delta Milwaukee Machine Tools.

Request both books today . . . Use coupon below.

Tear out coupon and mail today!

M-14

THE DELTA MANUFACTURING CO.
606N E. Vienna Ave., Milwaukee 1, Wis.

Please send me my free copy of the 76-page Blue Book and catalog of low-cost Delta-Milwaukee Machine Tools.

Name.....

Position.....

Company.....

Address.....

City.....(.....) State.....

Delta Floor-Type Multiple-Spindle Drill Presses

4-spindle model illustrated. 2-spindle model also available with one-piece table. Floor types with sectional tables: 3-, 4-, 5-, 6-, and 8-spindle models.

Delta Power-Feed Drill Presses

Worm-driven power feed gives 8 rates of feed for each spindle speed. Instantly switched to sensitive hand drilling. 17-inch single-spindle drill presses available in 24 different models.

Delta 14" Floor-Type Drill Press

Patented construction provides *both* a self-aligning drive and a free-floating spindle. Features include smooth-working table-raising mechanism, built-in depth gauge, safety belt guard, etc.

These quality features minimize depreciation of your Delta-Milwaukee Machine Tools:

1. Lubricated-for-life New Departure ball bearings double sealed against abrasive shop dust.
2. Pre-loaded bearings with unnecessary play between balls and races eliminated.
3. Precision-bored bearing seats that help keep shafts accurately aligned.
4. Balanced pulleys prevent the transmission of belt vibration to spindle.
5. Precision-ground shafts run true, smoothly, and without vibration.

Delta Cut-Off Machine

Eliminates expensive finishing. Available at a fraction of the usual cost for machines of this type. Three models — with abrasive wheel, for cutting steel; with steel blade, for cutting plastics and non-ferrous metals with polished smoothness; with cross-cut blade, for cutting wood.

SERVICE REPORT

THE PARKER APPLIANCE COMPANY

This is the present status of the case in which a Parker Triple Fitting replaced a wrought iron elbow, which was braised to the static pressure lead in a gas meter.

Under pressure surges -- from 5 pounds to 4,000 pounds -- the wrought elbows frequently exploded, destroying the meter dial and spraying out broken metal and shattered glass.

Meter readers feared to go near these meters, service costs were high and the company was losing business.

When Parker 1/8" triple fittings replaced the wrought iron elbow, results were:

1. Reduced installation time.
2. Safe handling of all pressures involved.
3. No injured hands for workmen (installation was in a hard-to-reach corner).
4. Flared type fitting easily serviced, if necessary, by customer's maintenance men.

Company then made same replacement on equipment in service -- all trouble eliminated.

Association promoting industrial gas meters reported that Parker triple type fitting has proper flare angle to withstand high pressures, and provided tight connection without injury to tubing.

The patented Parker Triple Coupling—easy to install and service—proof against leakage and vibration.

The principle of this coupling is the basis for modern Fluid Power Systems.

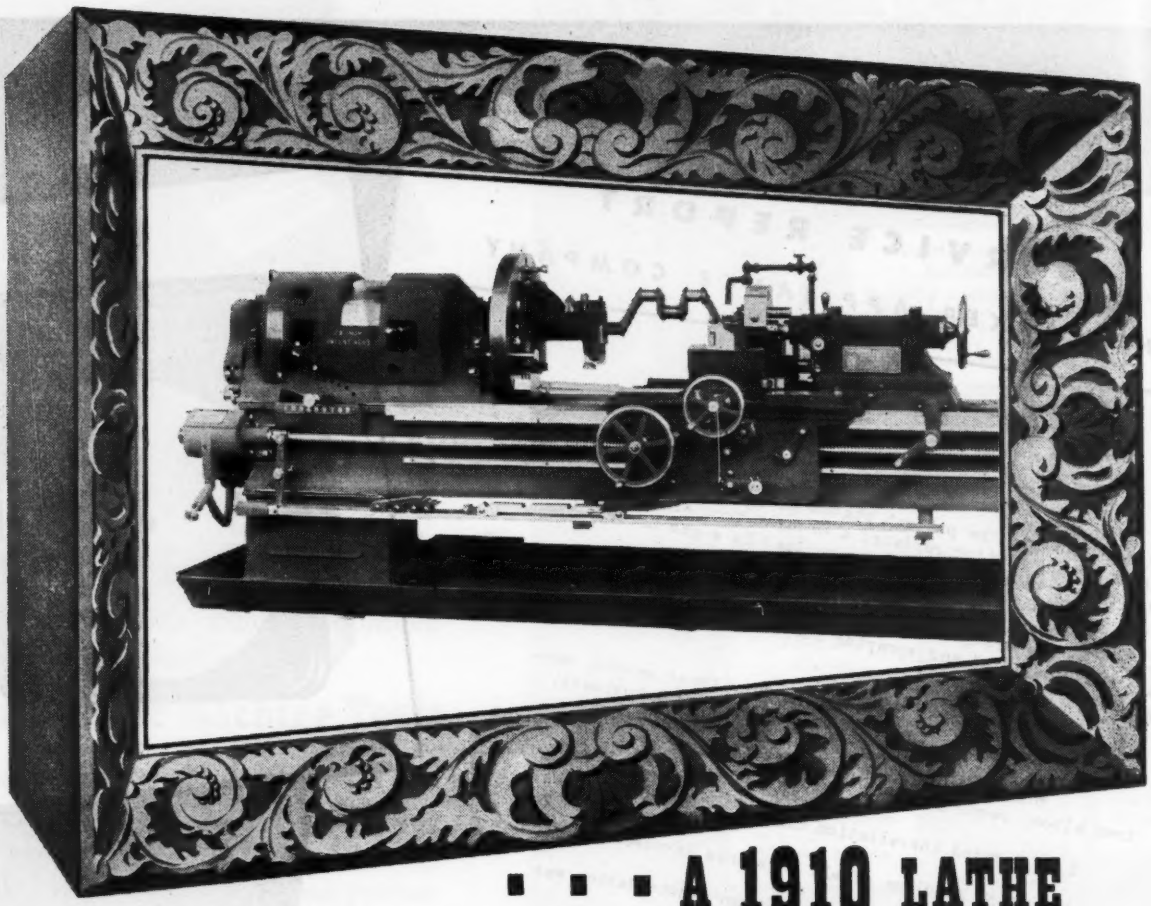
The record of Parker couplings, valves and fabricated tubing is one of complete dependability in both war and peace.

Whatever you make, or plan to make, consult a Parker Fluid Power engineer on tubing systems for either fluid or power transmission. The Parker Appliance Company, 17325 Euclid Ave., Cleveland 12, Ohio.

THE PARKER APPLIANCE CO.

CLEVELAND • LOS ANGELES

FLUID POWER PRODUCTS FOR ALL INDUSTRY

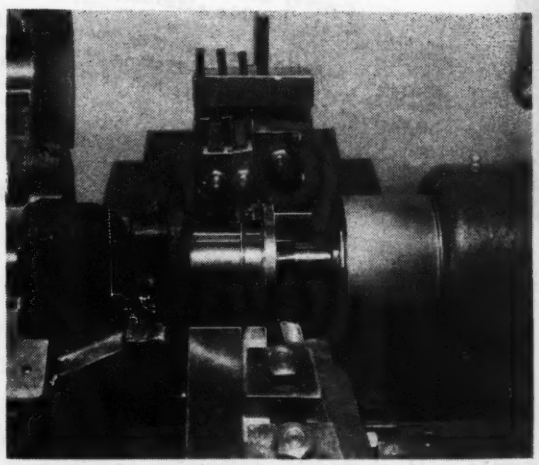


. . . A 1910 LATHE *for Today's Crankshaft Jobs?*

● The "old timer" pictured above was mighty good for its day. On a crankshaft job one tool in a simple toolholder was then adequate. But feeds and speeds were unbelievably slow . . . rapid duplication of parts impossible. And skilled operators were essential.

Consider, in contrast, today's latest 2A or 3A Duomatic—Lodge and Shipley full automatic lathes. View at the right also shows a crankshaft job—with six tools cutting simultaneously. Dual tool slides—front and rear—operate singly or together, permit any combination of "in" or "out" facing cycles, turning, boring or forming, *without special attachments!* Unskilled operators produce large or small lots with equal facility.

If you have "antiques" or war-weary lathes call in L & S Engineers. A modern L & S Lathe can replace several of these out-worn tools—give you production, accuracy, and low costs never before possible.



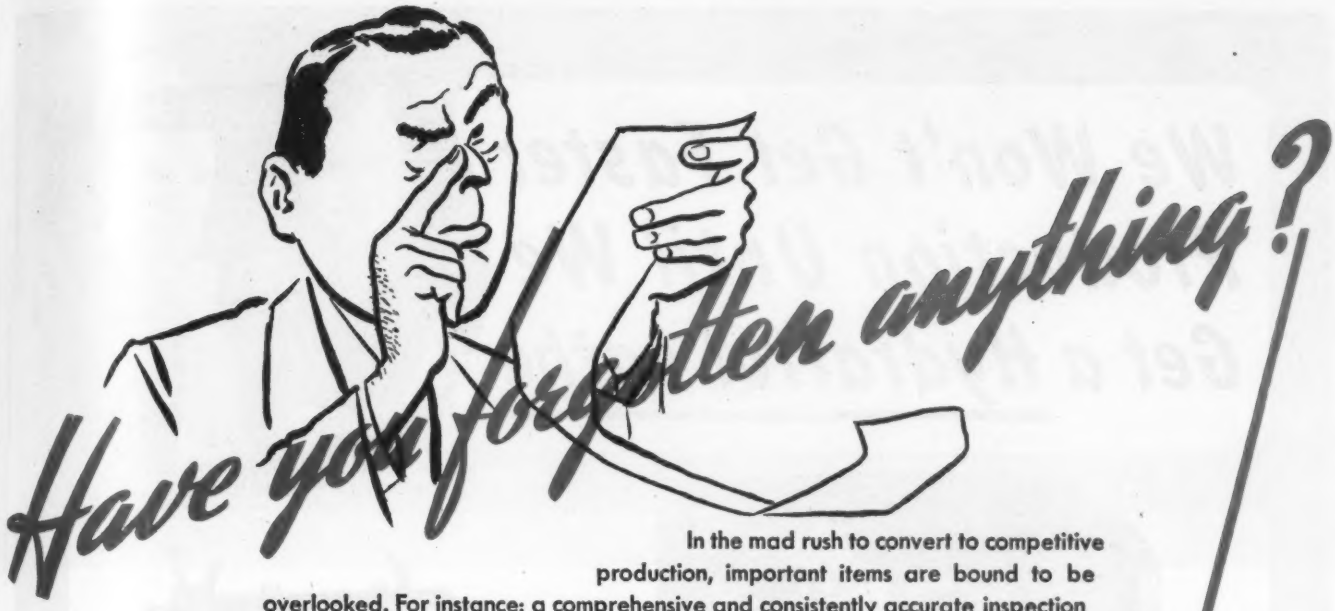
Write on your company letterhead for detailed literature on the following: Engine, Tool Room, Automatic, Manufacturing, Oil Country Lathes.

THE LODGE & SHIPLEY MACHINE TOOL CO.

L & S LATHES

CINCINNATI 25, OHIO, U. S. A.

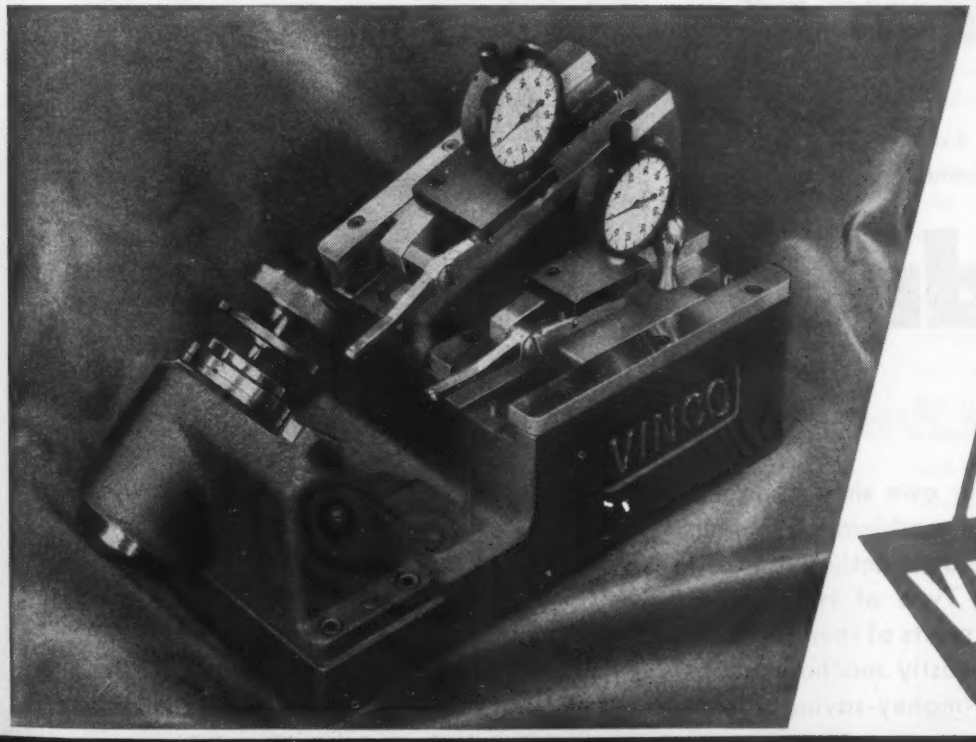
MACHINE TOOL DIVISION 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION 800 EVANS ST.



Have you forgotten anything?

In the mad rush to convert to competitive production, important items are bound to be overlooked. For instance: a comprehensive and consistently accurate inspection control of related parts, vitally essential to future quality production.

It is too apparent for comment that future designs will depend on precision parts if these designs are to function correctly. It is equally apparent that the selection of reliable gages and a proper over-all gaging method will play a large part in the correct assembly and interchangeability of parts. One way to insure this is to join the ever-increasing ranks of those who use Vinco's Gage Engineering Service when planning new production schedules. At all times, Vinco is ready to discuss the complete subject of gaging, together with the attendant problem of production, with your engineering staff. Our assistance to your engineers in establishing and setting up a complete and comprehensive gaging policy, suited to your individual needs, will be gladly given.



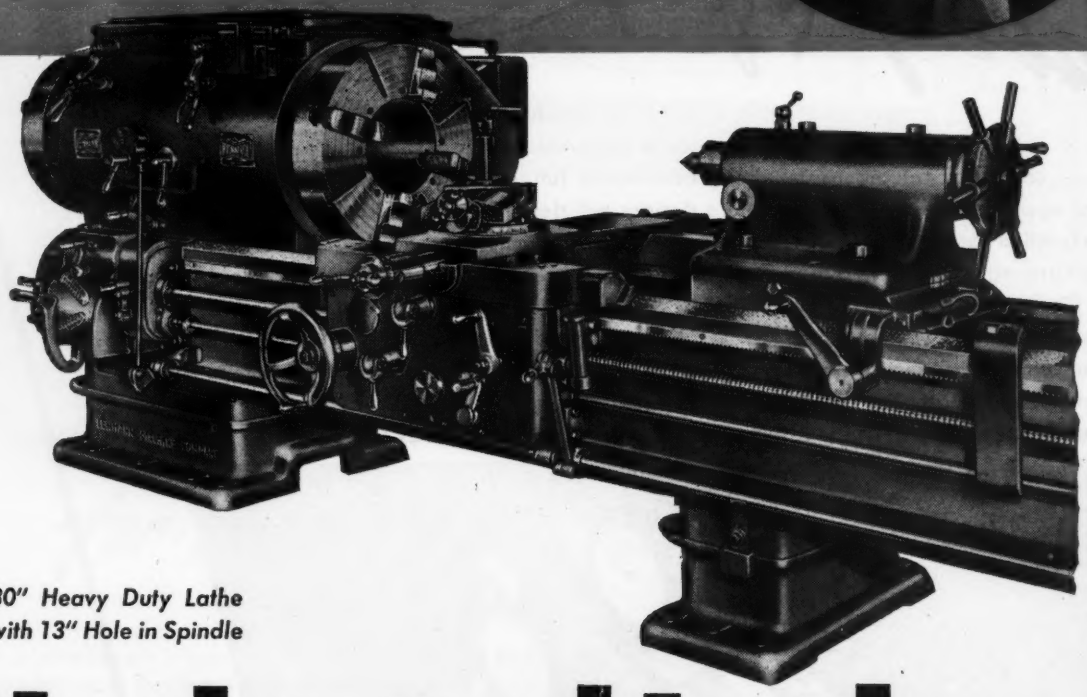
MILLIONTHS OF AN INCH FOR SALE BY VINCO

REG. U. S. PAT. OFF.

VINCO CORPORATION, 8853 SCHAEFER HIGHWAY, DETROIT 27, MICHIGAN; SALES OFFICES, NEW YORK, CHICAGO, CLEVELAND

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Shaft and Hub Gages • Built-up and Special Gages • Gear Rolling Inspection Fixtures • Indexing Fixtures • Hydraulic Power Control, Utilization and Distribution Units • Engineering, Design and Development • Precision Production Parts.

We Won't Get Faster Production Until We Get a Hydratrol Lathe



30" Heavy Duty Lathe with 13" Hole in Spindle

Hydratrol Lathes

LARGE HOLLOW SPINDLE TYPE

For Faster Production...Better Work...Lower Costs!

Look around your own shop—you may find a number of machining jobs which could possibly be done better on a Large Hollow Spindle Type of HYDRATROL LATHE. Send us prints of these unusual, difficult, or too-costly machining jobs, for a time-and-money-saving recommendation.

5 Sizes-18" to 36"

Small.....18" up to 7¼" Hole
Medium.....24" up to 12" Hole
Large.....27" up to 13" Hole
Large.....30" up to 14" Hole
Large.....36" up to 16½" Hole

(Standard type lathes, 16" to 36")

Lehmann MACHINE COMPANY

CHOUTEAU AT GRAND . . . ST. LOUIS 3, MISSOURI

A 2000-ton H-P-M FASTRAVERSE press is used to cog and preblock cylinder heads for radial engines. Billet is 18-S aluminum, 10¼" dia. x 8" high, weighing approximately 70 pounds.

Look at the metal you can move with each stroke of the H·P·M FORGING PRESS!

Actual production results in forging aluminum parts prove that H-P-M All-Hydraulic Forging Presses will out-produce drop hammers 2 to 1. Normally 5 to 10 hammer blows are required to obtain the same amount of metal movement that can be secured with a single press stroke. Die life has been increased as much as twenty times. Scrap losses have been held down to less than 0.1 percent. Relatively unskilled help can be employed to operate H-P-M presses, and forging crews need not be spelled off. The structure, grain flow and strength of hydraulic press forgings compare equally with those produced in impact forging machines. Investigate H-P-M presses for your forging requirements. You can forge it faster and cheaper with an H-P-M press.

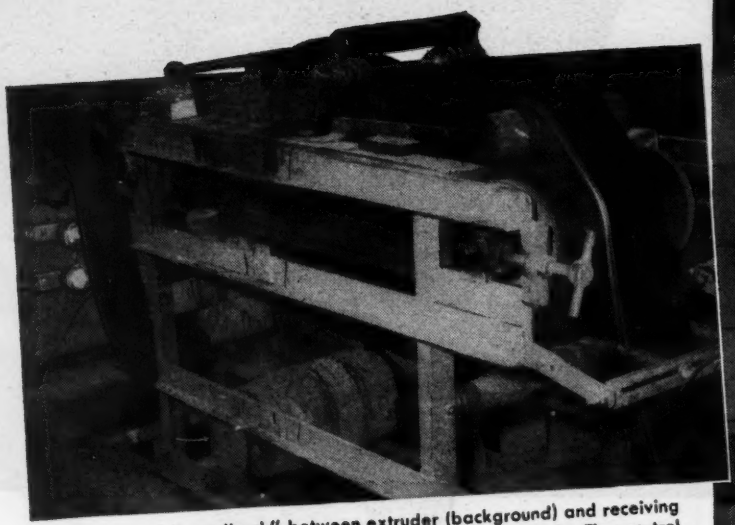
THE HYDRAULIC PRESS MFG. CO.
MOUNT GILEAD, OHIO, U.S.A.
Branch Offices in New York, Philadelphia, Cleveland, Detroit & Chicago. Representatives in principal cities.

HPM

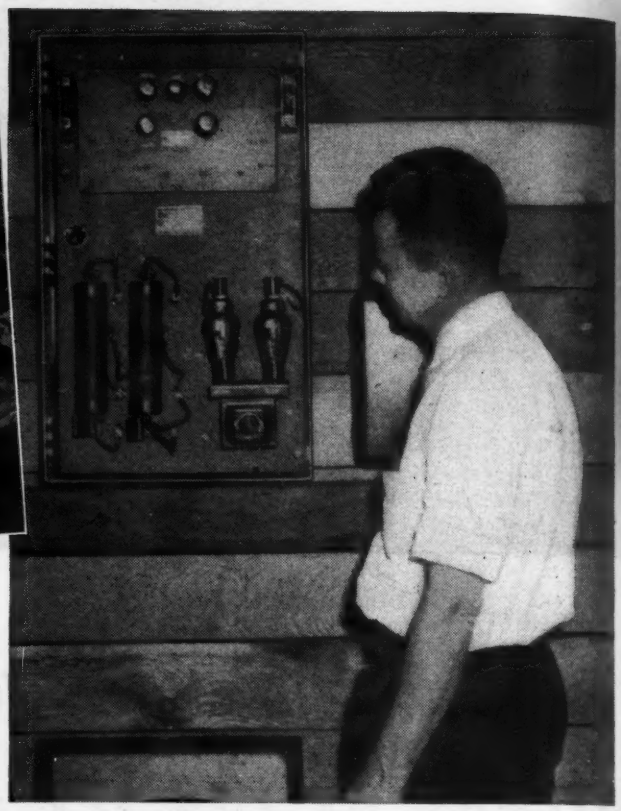
REVOLUTIONIZING PRODUCTION

All-Hydraulic Fastraverse
FORGING PRESSES

WITH HYDRAULICS SINCE 1877



A loop of "camelback" between extruder (background) and receiving conveyor actuates a photoelectric control to maintain the Thy-mo-trol driven conveyor at the right speed.



Thy-mo-trol control panel (cover removed), which controls the speed of the d-c conveyor motor

ELECTRONIC SPEED-MATCHING

of tire-tread machines

helps raise production 100%

Continuous production of "camelback" tire-tread at the plant of W. J. Voit Rubber Corporation, Los Angeles, is now maintained at twice the former rate, using a new speed-matching system which combines a photoelectric control and a G-E Thy-mo-trol drive.

At speeds ranging from 8 to 80 feet per minute, a receiving conveyor is kept in step with an extruder—avoiding "pile-ups" or breaks in the strip between the two machines.

VERSATILE SPEED CONTROL

This arrangement for automatic speed control is typical of dozens of ingenious applications employing Thy-mo-trol drive, on production lines as well as on individual machines. Powered directly from an a-c source, Thy-mo-trol is an adjustable-speed drive with exceptional control characteristics. It gives stepless speed control over a wide range, holds speeds constant under changing loads, and offers rapid, controlled current acceleration and dynamic braking. Speeds can be pre-set from a small dial that's part of the push-button control station.

A COMPLETE DRIVE

Standard Thy-mo-trol drives are available from 1/8 to 25 horsepower. And larger sizes can be furnished. Four compact units—d-c motor, electronic panel, power transformer, and control station—make up the complete drive. For full information, call your local G-E representative. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

676-191

THY-MO-TROL DRIVE

Keep on buying BONDS—*and keep all you buy*

Turn your difficult milling problems into routine production jobs

NEWTON SPECIAL RAM TYPE MILLING MACHINE

Among Heavy Machine Tools built by Consolidated are . . . .

- LATHES
- BORING MILLS
- DRILL PRESSES
- MILLING MACHINES
- BORING MACHINES
- COLD SAW MACHINES
- PLANERS
- SLOTTERS
- RAILROAD SHOP TOOLS
- AUTOMOTIVE TOOLS
- AND OTHER SPECIAL MACHINES

This special cylinder block milling machine is another example of the wide, diversified range of machine tools engineered and built by Consolidated. Designed for milling bearing locks and ends of main bearings on cylinder blocks, it is in successful operation reducing that highly specialized job to a production basis.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1861

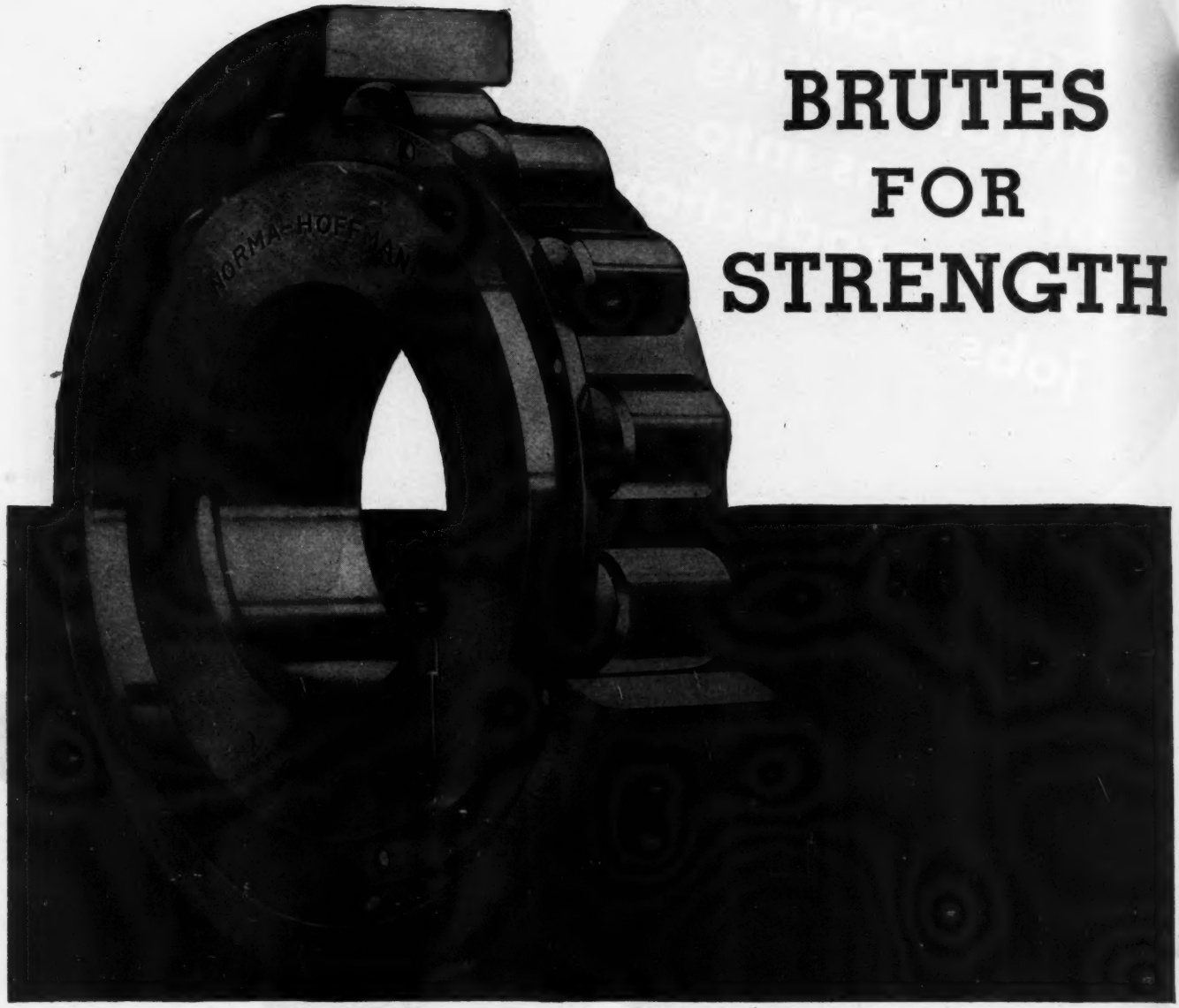
BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED

MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK



BRUTES FOR STRENGTH

THE outstanding performance records made by NORMA-HOFFMANN PRECISION ROLLER BEARINGS under the heaviest and most exacting duties, are the logical result of the following distinctive factors:

Full line contact of rolling surfaces, affording a larger radial load capacity for continuous and intermittent service than any other type of single-row bearing, and providing a temporary overload capacity 50% above normal catalog rating, with greater resistance to shock and vibration.

Highly durable, completely machined and balanced bronze retainer riding on inner ring shoulders and minimizing internal load.

Lower frictional coefficient under heavy loads than any other single-row anti-friction bearing—due to extreme precision and design characteristics.

Test these PRECISION ROLLER BEARINGS in your own hardest service; remember that they have all the high speed qualities of the best ball bearings, and are interchangeable, size for size, with all single-row metric ball bearings.

Write for the catalog. Let our engineers work with you.

"NORMA-HOFFMANN"

PRECISION BALL, ROLLER and THRUST BEARINGS

NORMA-HOFFMANN BEARINGS CORPN., STAMFORD, CONN. U.S.A.

Solve Vexing Post-War Production Problems with

"HYDRAULIC" CONTROL AND RELIEF VALVES

Want speedier production, lower manufacturing costs? Investigate the advantages of Hydraulic Power for smoother, simpler, more efficient machine control and the actuation of various types of equipment . . . infinite changes in speeds and feed rates . . . automatic changes in rate and direction of movement until a cycle of operations is completed. And to assure topnotch operation – specify HYDRAULIC PRODUCTS Control and Relief Valves. Every one of these Valves is tested with 3600 operations under 125% of normal operating conditions. Illustrated at right (reading downward): (1) Relief Valve (Type R75) for regulating and limiting fluid pressure. Pressure range 0-1000 lb., pipe sizes 1/2" to 1-1/4". (2) Hand-operated 4-way Control Valve (Type HCC75); used where remote control is not desired. Pressure range 0-1000 lb., pipe sizes 1/2" to 1-1/4". (3) 4-way Control Valve (Type U100), solenoid-operated. Pushbutton control. Pressure range 0-1000 lb., pipe sizes 1/2" to 1-1/4". All HYDRAULIC PRODUCTS Valves have full port openings and free flow internal passages. Careful design, best raw materials and careful workmanship assure dependable performance under most severe operating conditions. Send for bulletin (below), which gives complete specifications for each type of Valve. Without obligation, our Engineering Department will be glad to submit recommendations covering your Relief and Control Valve requirements.

WRITE TODAY FOR YOUR COPY

You will find helpful data —and perhaps a profitable idea—in this bulletin which illustrates and gives specifications of HYDRAULIC PRODUCTS Valves.

WANTED: QUALITY DISTRIBUTORS FOR HYDRAULIC PRODUCTS

A limited number of distributorships are available in territories not now represented. A representative of our Company is ready to call upon well established distributors with a view to discussing details. To distributors who can qualify, we will offer terms which assure a mutually profitable arrangement in highly competitive post-war markets. Write.

"HYDRAULIC PRODUCTS FOR EFFICIENCY"

HYDRAULIC PRODUCTS CO.
525 W. 76th STREET, CHICAGO 20, ILL., U. S. A.

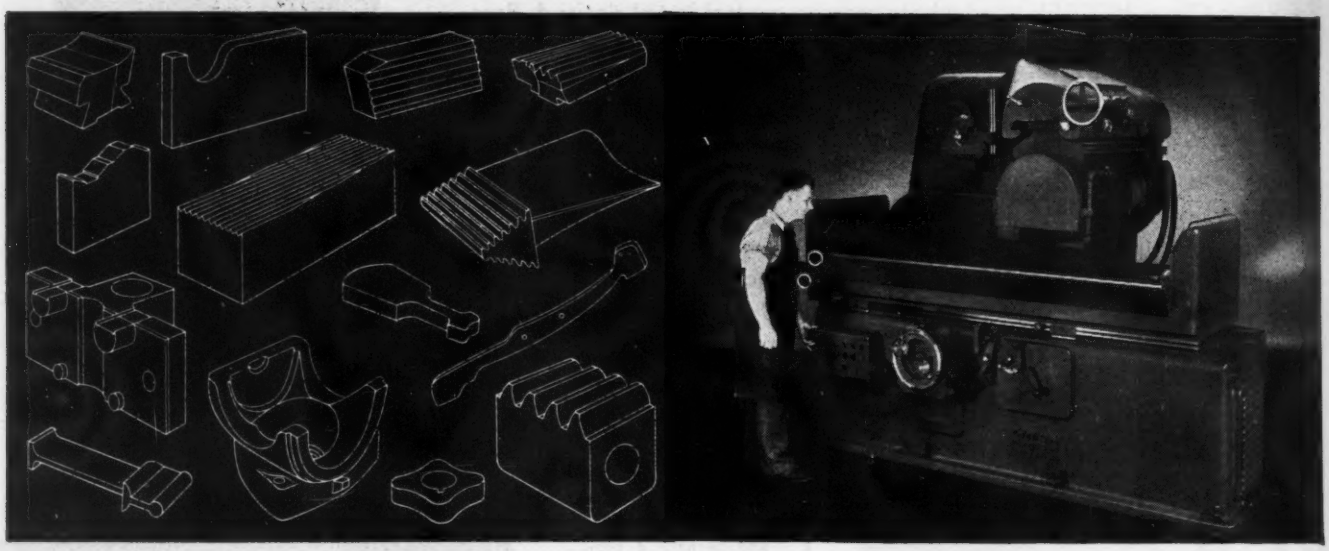
HYDRAULIC PNEUMATIC
TRADE MARK
MACHINERY

Important Message

to all interested in production of precision flat form contours

1. Contours like these can be produced more economically and accurately by a proven crush form grinding process known as *Thompson Truforming.* (REGISTERED TRADEMARK)

2. The ONLY machine that is *completely engineered and built* for crush form grinding precision contours is the new *Thompson Truform Grinder.*



3. To meet individual requirements, various types of automatic *Thompson Truform Grinders* are available. For advantages and complete pictorial production explanation send for this new book.

Send coupon for free copy

COPYRIGHT 1945
THE THOMPSON
GRINDER CO., INC

CRUSH FORM CONTOUR GRINDING DEVELOPMENT LABORATORY

The Thompson Grinder Co., Inc., Dept. 13, Springfield, Ohio

Gentlemen: Please send me your new 16 page pictorial book describing Thompson Truforming (Crush Form Grinding on Surface Grinders).

*Name*_____ *Position*_____

*Company*_____ *Address*_____

*City*_____ *Zone*____ *State*_____

Mahon Fabricated WELDMENTS

. . . no Job too Complicated

Here is another example of how far Mahon has gone in the art of producing Welded Steel Plate. This unretouched photo of a Diesel Engine Crank Case and Base, produced by Mahon craftsmen, tells a story not easily put into words . . . certainly few jobs could be more complicated from the welder's standpoint. The skill and precision illustrated here is typical of what you may expect from the Mahon organization. Thoroughly experienced design engineers are available to you for consultation on unusual adaptation problems.

Address inquiries to STEEL PLATE DIVISION

THE R. C. MAHON COMPANY

Home Office and Plant, Detroit 11, Michigan
Western Sales Division, Chicago 4, Illinois

Fabricators of Welded Steel Machine Bases, Frames, and Many Other Welded Steel Products

MAHON

PRODUCTION INCREASED 4 TIMES...

● Valve cover pads for automobile engine blocks are milled two at a time on this special 2-spindle Ingersoll at the rate of 100 per hour.

The operator positions 2 blocks, side by side, at the loading station. The blocks are automatically clamped, fed through the milling cutters, and ejected at the back of the machine.

Besides increasing production 4 times over the old methods, power clamping and transferring of the cylinder blocks greatly decreases the work of the operator.

● Closeup showing cylinder block and milling cutter.

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

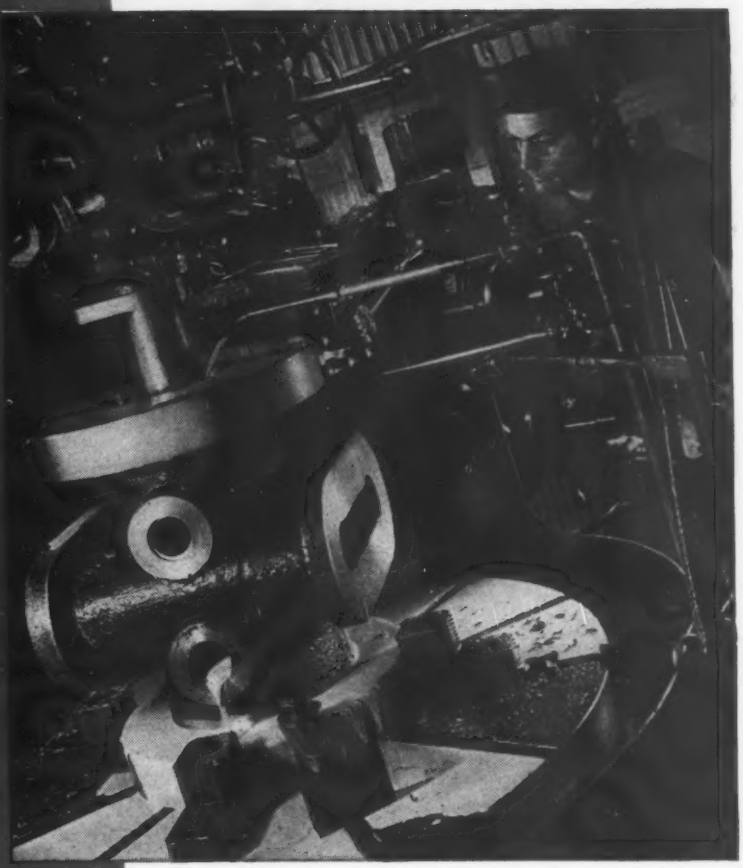
INGERSOLL

SPECIALIZED MILLING, DRILLING, BORING, TAPPING, SCALPING MACHINES

FASTER, FINER MACHINING at LOWER COST

when cutting fluids...

- ★ Lubricate and cool the tools
- ★ Prevent chip welding
- ★ Permit higher cutting speeds
- ★ Prolong tool life
- ★ Improve surface finish



WHATEVER the metal or the method of machining, you can cut faster, better, and more economically with *Texaco Cutting and Soluble Oils*. These superlative cutting fluids not only bring you the benefits headlined, but assure more cuts per tool grind, less downtime for tool changes.

There is a complete line of Texaco cutting fluids, each designed to improve the efficiency of a particular type of cutting. Each has been developed through careful research and practical field applications . . . and each is kept abreast of advances in metallurgy and machining techniques by the continuing work of The Texas Company's staff of research chemists and engineers.

A Texaco Engineer specializing in cutting coolants will gladly help you improve your machining procedures. Get in touch with the nearest of more than 2300 Texaco distributing plants in the 48 States, or write to The Texas Company, 135 E. 42nd St., New York 17, N. Y.

RECONVERSION RUSTPROOFING

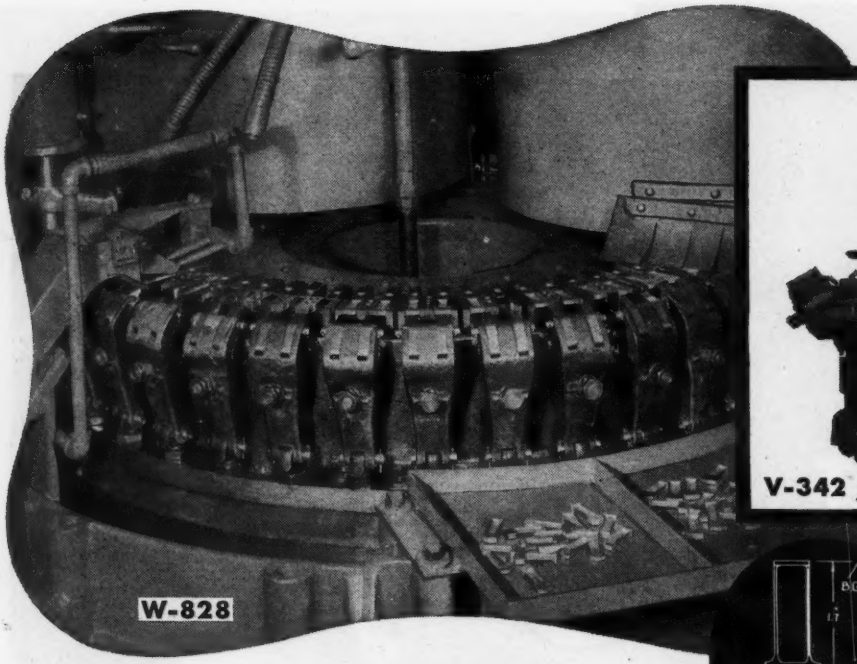
4 Points to Remember

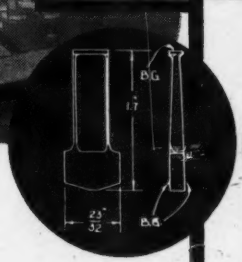
1. Ordnance Specification P.S. 300-4 contains *official instructions* for the complete processing of Government-owned production equipment.
2. These instructions require that only rustproofing materials meeting Government specifications be used.
3. *Texaco rustproofing products meet Ordnance specifications for application on Government-owned equipment.*
4. For full information, see your Texaco representative or write to us.

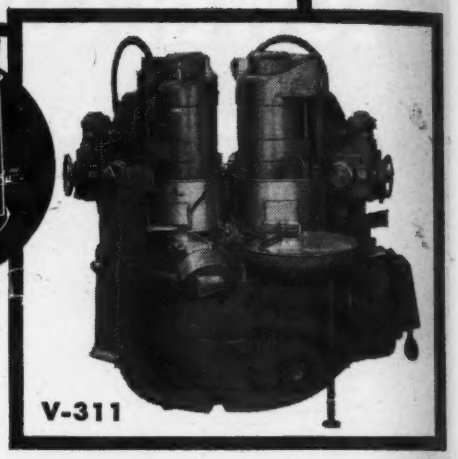
TEXACO

TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING

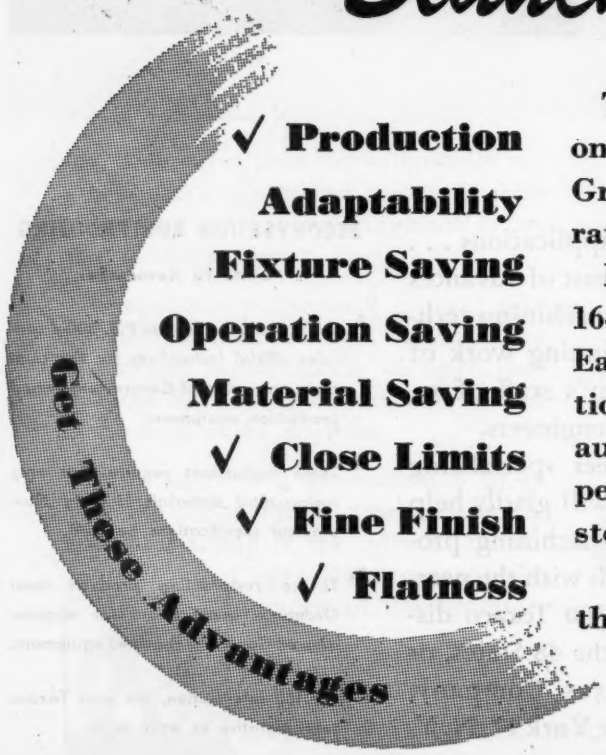
TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON SUNDAY NIGHTS ★ METROPOLITAN OPERA BROADCASTS SATURDAY AFTERNOONS







"Put it on the Blanchard"



- ✓ Production
- Adaptability
- Fixture Saving
- Operation Saving
- Material Saving
- ✓ Close Limits
- ✓ Fine Finish
- ✓ Flatness

These buckets of cast stainless steel are ground on one end on a No. 16-A Blanchard Automatic Grinder, locating from the inside surfaces, at the rate of 1800 per hour.

Following this operation they come to two No. 16-A2 Blanchards for grinding the tapered sides. Each 16-A2 Blanchard is equipped with an 80 station fixture which clamps, unclamps and ejects automatically, each machine grinding 1300 pieces per hour on one side, removing .008″ to .010″ of stock per side to limits of ±.0005″.

The reduced cost per piece, after transferring this operation to the Blanchard, is obvious.

Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

Frame production at The Murray Corporation of America, with "Hy-Power" hydraulic riveters.

"Hy-Power" riveting speeds frame production . . .

Modern automotive frames, with their large number of rivets, can be economically produced principally because of the development of modern progressive assembly and the speed and ease of handling of Hannifin "Hy-Power" hydraulic riveter equipment. The cold rivet squeezing action is a completely automatic cycle controlled at the touch of a push button. Hannifin riveter yokes can be provided in a wide range of standard types, shaped to provide easy handling and access to any rivet location. The leading producers, all around the world, have used Hannifin "Hy-Power" hydraulic riveters for ten years.

Hannifin "Hy-Power" equipment meets today's needs for fast production, uniform quality of work, and continuous performance. Write for "Hy-Power" bulletin, or consult Hannifin engineers for specific recommendations.

Hannifin Manufacturing Company, 621-631 South Kolmar Avenue, Chicago 24, Illinois.

HANNIFIN · CHICAGO · U.S.A.

Hannifin

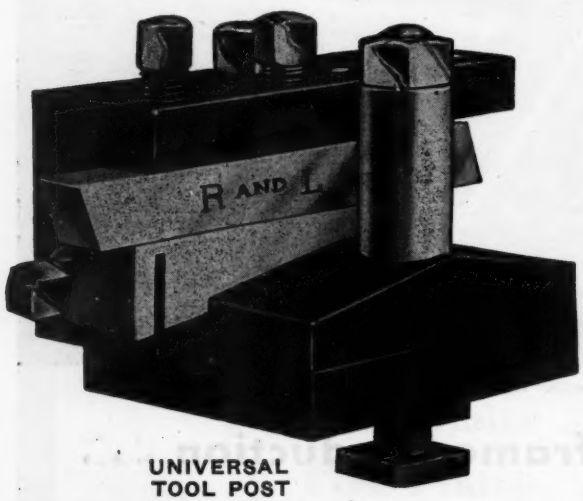
"Hy-Power" RIVETERS

Speed OPERATIONS! *Cut* COSTS! ...USE

R AND L TURNING TOOL

Does the work of fourteen separate tools and saves over $200 in first cost alone. Made in five sizes.

RIGHT R AND LEFT L TOOLS



UNIVERSAL TOOL POST

Can be used to hold flat or square tools on front or back cross-slide with the spindle running either direction.

TAP AND DIE HOLDER

New design eliminates spring plungers and small screws. Engaging teeth separate fully — and instantly — when released, eliminating wear.

R and L multiple operation, easy set-up, right or left hand features multiply the productive capacity of your present equipment, show the way to FASTER production and LOWER machining costs!

Set up **R and L Turning Tools** (above) on your turret lathes and screw machines. Use them to perform two or three simultaneous operations such as drilling and turning; pointing and form turning; turning, centering and burnishing. Many other combinations easily accomplished.

Use the **R and L Universal Tool Post** (left, upper) on the front or rear cross-slide, holding square or flat tools, with the spindle running in either direction.

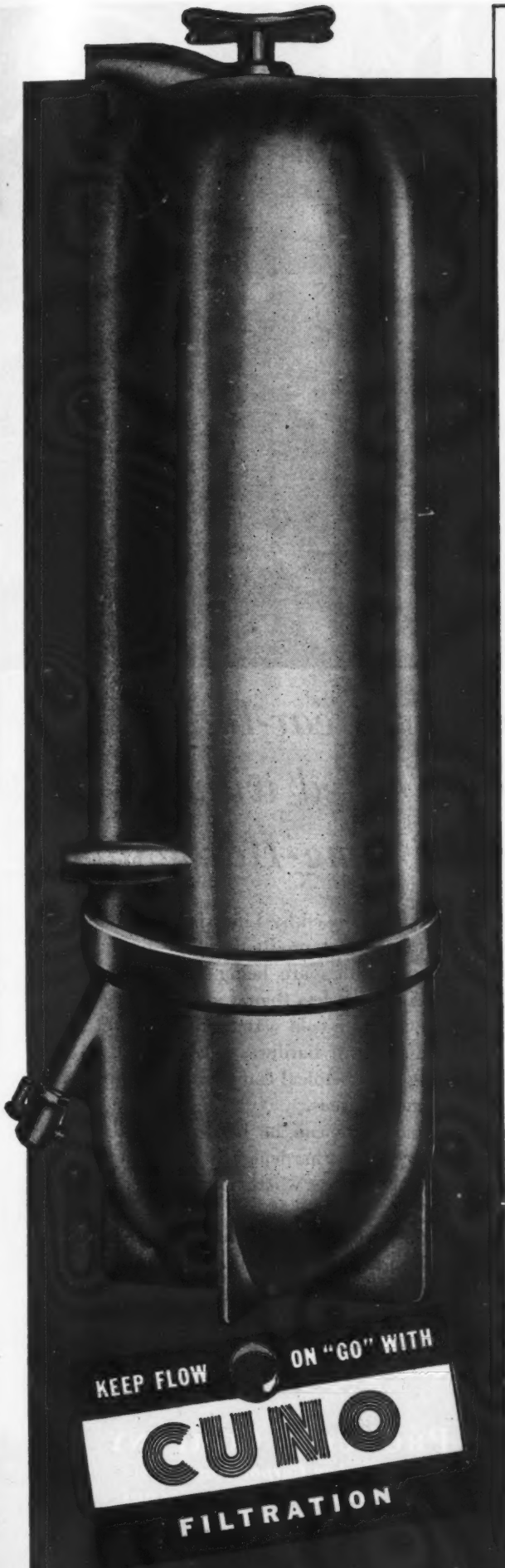
Use the **R and L Tap and Die Holder** (left, lower) for both right and left hand threading. Its new design eliminates spring plungers, makes action fast and positive.

Discover the possibilities of these versatile, money-saving tools! Write —

R AND L TOOLS

1825 Bristol Street

Nicetown, Philadelphia, Pa.



Fine Finishes

...less filter cleaning with this lower-cost filter

Cuno's new COOLANT-KLEAN was developed especially for grinder coolants to help produce scratch-free surfaces . . . greatly extend wheel life and make element replacement quick and easy.

Here's new assurance of better finishes — and savings in filter cost, maintenance and replacement, plus a bonus in longer coolant life.

Firms using Cuno's new COOLANT-KLEAN have expressed amazement at the greater amount of dirt collected . . . the infrequency of bag replacement . . . and the elimination of "pick-ups" on the work.

You can now obtain — with COOLANT-KLEAN — extremely fine finishes, even at the end of an up-to-6-weeks period without changing the bag. Coolant stays cleaner—needs changing less often. Less loading of the wheel, too.

LOWEST-COST FILTER

COOLANT-KLEAN meets specifications at lowest cost. It is priced less, to begin with, than most filters. Maintenance is less — fewer new bags, less time for replacement (under 5 minutes), lower cost of new element — than for any other comparable replacement-element filter.

NEW CONSTRUCTION PRINCIPLE

COOLANT-KLEAN handles full flow of coolant or cutting oil, yet requires less floor space than other, more expensive types. No filter aid needed. Eliminates precoating time. Gets away from "stuffed type" elements. Is applicable to individual machine or central system.

DESCRIBES "FINER FINISHES AT LESS COST"

This newest advance in coolant-cleaning is described in Bulletin 3110. Send coupon now for your copy. Find out how simple it now is to obtain finer finishes at less cost.

SEND COUPON FOR INFORMATION ON FILTERING COOLANT

CUNO ENGINEERING CORPORATION
133 South Vine Street, Meriden, Connecticut

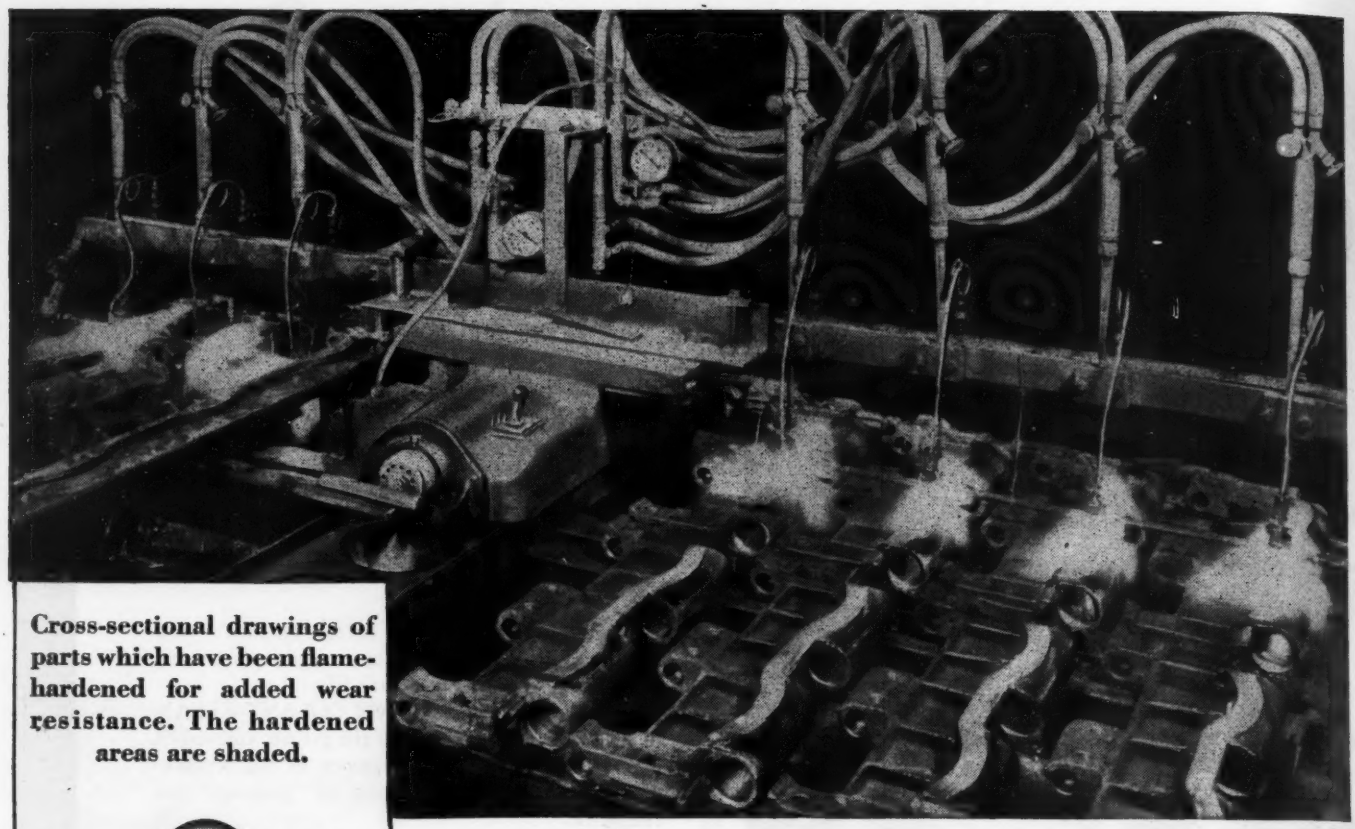
Gentlemen: Rush information on your new COOLANT-KLEAN filter for grinder coolants.

Name.....

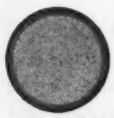
Company.....

Address.....

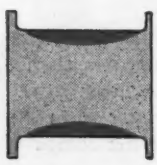
Please send representative ☐



Cross-sectional drawings of parts which have been flame-hardened for added wear resistance. The hardened areas are shaded.



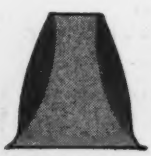
Shaft



Crankshaft Bearing

Lathe Way

Sheave Wheel



Gear Tooth

You Get Greater Wear-Resistance Where Needed with Oxy-Acetylene Flame-Hardening

Oxy-acetylene flame-hardening as developed by Linde is a completely automatic process which can be applied at production-line speeds. In the picture above seven tank tread shoes are being flame-hardened simultaneously. The entire operation takes less than 4 minutes.

The oxy-acetylene flames, followed by a cold water quench, give the wearing surfaces of the treads a uniform hardness — controlled to a depth of 3/16 in. — without affecting the chemical composition, ductility, or toughness of the core or surrounding areas.

A variety of steel and cast iron parts can be hardened easily by Linde's method. Even parts too large to be hardened by other methods can be flame-hardened at exactly the points where wear occurs...and without distortion.

You can get the flame-hardening apparatus and supplies you need from Linde, and Linde can show you how to use them.

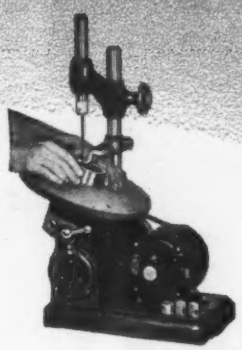
Write for the booklet, "Flame-Hardening," Form 4726.

BUY AND HOLD UNITED STATES VICTORY BONDS AND STAMPS

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities
In Canada: Dominion Oxygen Company, Limited, Toronto

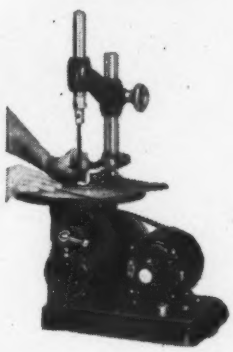
3 JOBS WELL DONE *on the*

ILLINOIS DIE FILING MACHINE



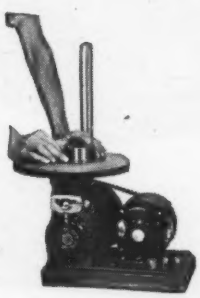
1 - FILING

Designed for filing of intricate die shapes...table can be tilted to right or left up to 20° from horizontal. Hand files can be used.



2 - SAWING

The table has a removable ring insert so that blank sizes of saws and files up to 6" length can be accommodated. Saw guide may be utilized as a hold-down finger.



3 - STONING

A finishing stone can be installed easily and quickly — which emphasizes the utility of this versatile machine that performs three major production steps: filing, sawing and stoning.

RAPID AND ACCURATE PERFORMANCE OF CRITICAL FINISHING OPERATIONS

PRECISION and BALANCE mark the Illinois Die Filing Machine which is designed to save time and do a superior job on finishing intricate die shapes. Convenient and adaptable, it is built with extreme precision and durability. Working parts are hardened and ground for accuracy and long life. Automatic forced feed lubrication reduces wear to a minimum. The Illinois Die Filing Machine relieves tedious hand filing of intricate shapes and assures greater accuracy at lower cost. Write for descriptive literature, today!

Overnight to All America . . . From the Hub of Air Transportation.

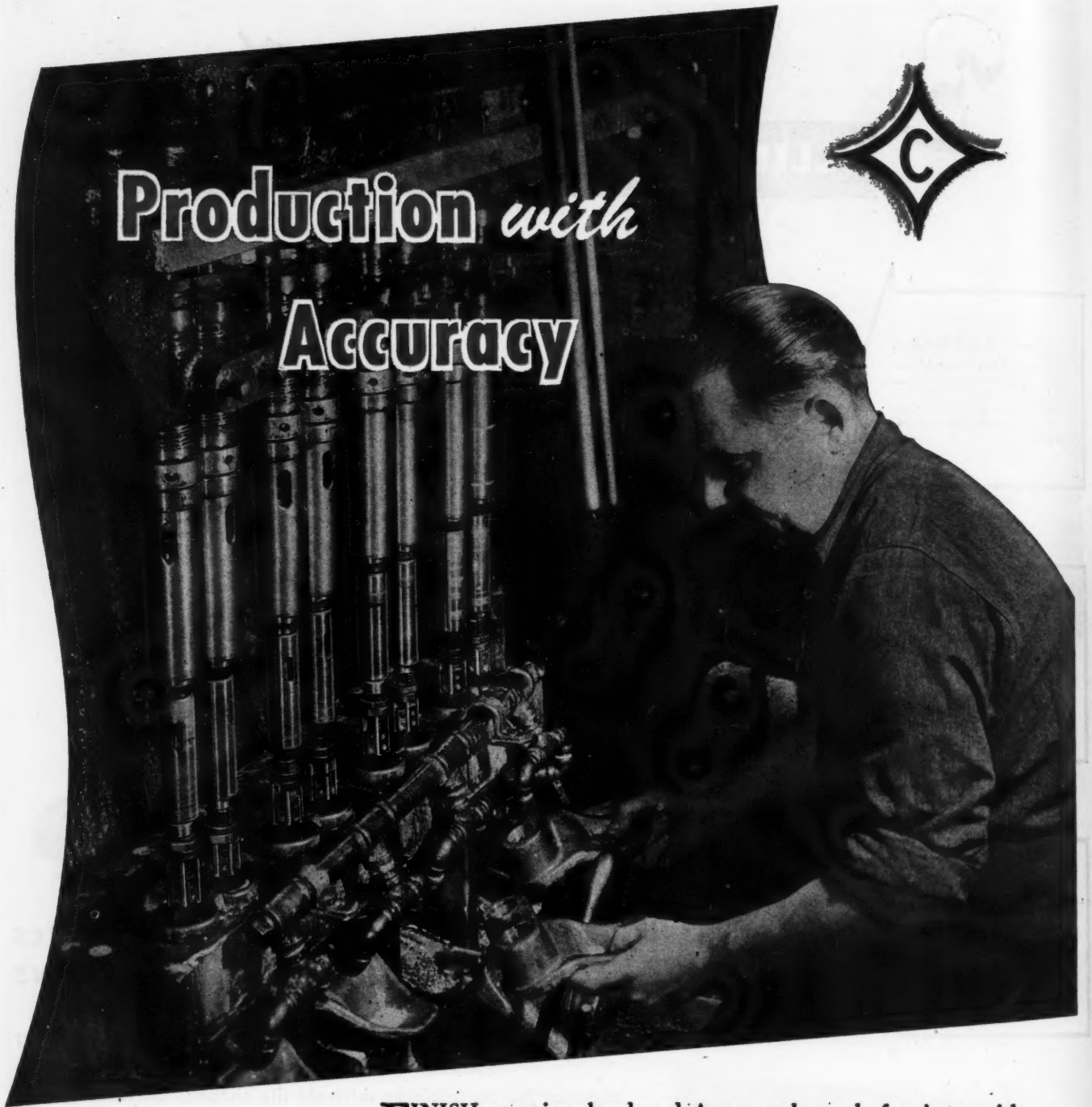
ILLINOIS TOOL WORKS

2501 N. KEELER AVE. CHICAGO 39, ILLINOIS

In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

Production *with* Accuracy



FINISH reaming hardened Army tank track forgings with CLEVELAND Expansion Reamers. 3200 holes per day reamed with accuracy.

Typical of the many instances where skill and dependable CLEVELAND tools enable contractors to exceed production schedules.

The ◈ trade mark has been the symbol of precision in tools since 1876. Specify CLEVELAND Twist Drills, Reamers, Screw Extractors, Arbors, Mandrels, Sockets, Mills, Counterbores and Carbide Tipped Tools for *uniformity* and *performance.*

Telephone YOUR I S D FIRST!

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49TH STREET
CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

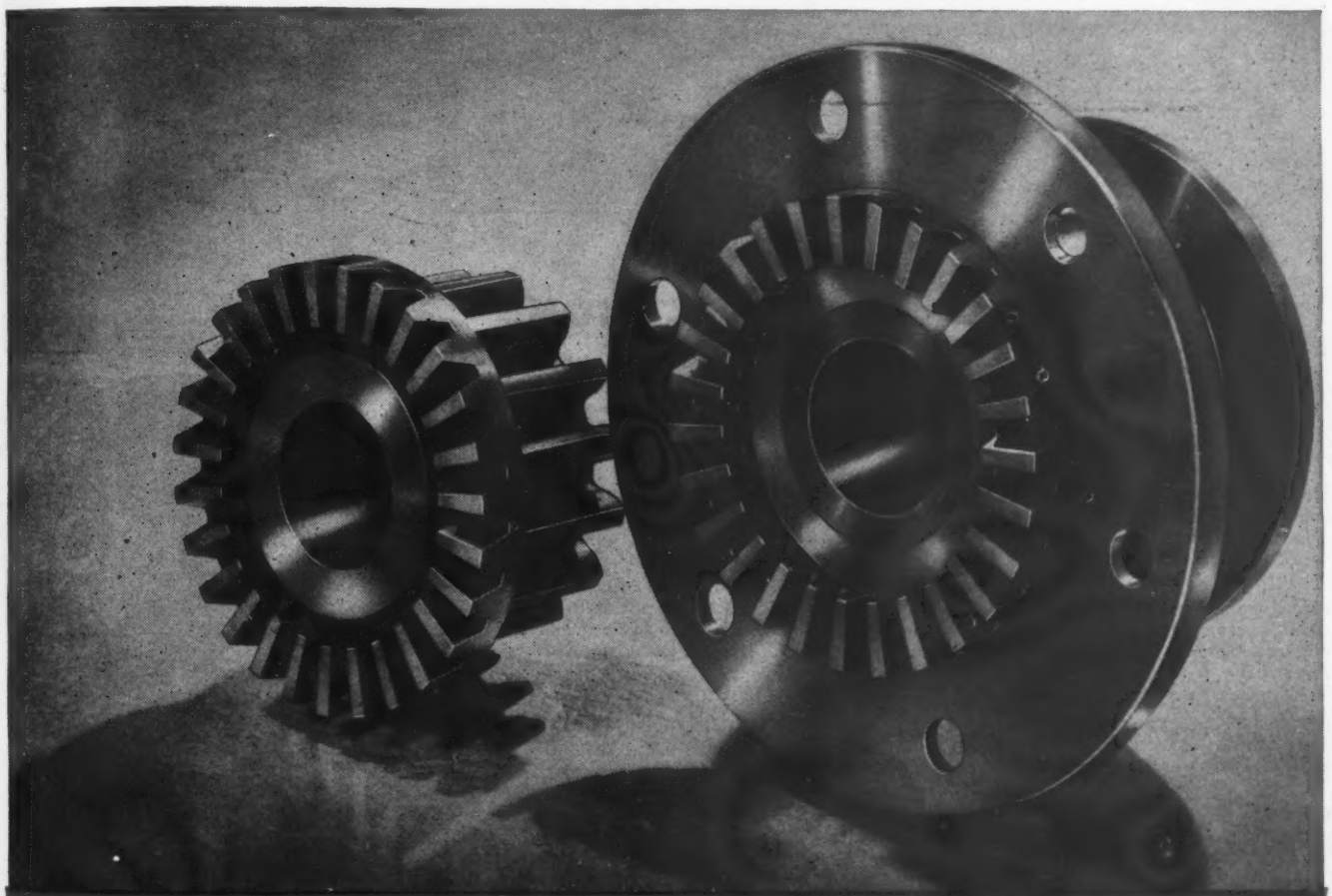
20 THOMAS ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 650 HOWARD ST. SAN FRANCISCO
6515 SECOND BLVD., DETROIT · BRUNEL ROAD, OLD OAK COMMON LANE, ACTON, LONDON W. 3, ENGLAND

CLEVELAND DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

Take Action

SPECIFY G–S SMALL GEARS

Gears are no better than the skill of the organization which produces them. No branch of the component part field is so dependent upon craftsmen. Wise buyers of gears know this fact and buy not a gear but the product of an organization which they know to be qualified to produce superior work. That's the reason why *G-S* is the world's largest exclusive manufacturer of small gears. This experience is not merely a statistic but is tangibly expressed in the ability of our organization to put the utmost quality in every job. *G-S* Small Gears offer economy, longer life, trouble-free operation, smooth performance, unfailing dependability. Let us discuss *your* Small Gear problems with you, *now!*



GEAR Specialties

Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding

2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

AIR — LAND — SEA

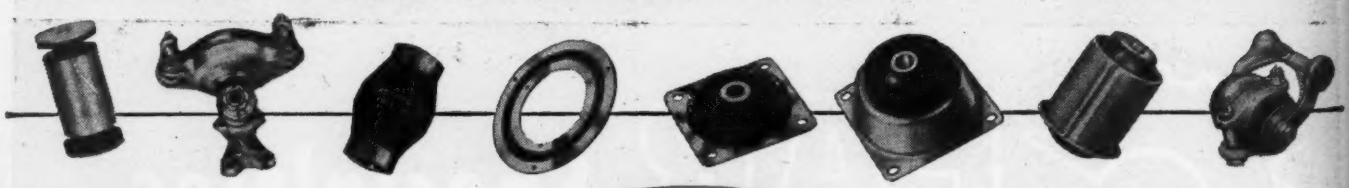
Radio, electronic and radar equipment is necessarily delicate in construction and necessarily precise in its functioning. The enormous recent advances, first made on paper, when translated into practice have almost invariably run into one major difficulty . . . vibrational interference.

So, Lord, pioneer and leader in subduing the harmful forces of vibration, has been called upon for a wide range of applications in this field. Where possible, outside vibration forces have been isolated at their source; vibration of component parts has been controlled; and delicate parts and instruments have been protected from outside interference by isolation.

Lord engineers, the most experienced in the field of vibration, have access to the greatest file of experimental data and case studies of practical experience in existence, and they have the largest assortment of mountings, all of exclusive Shear Type Bonded Rubber and every one engineered for the specific conditions it has to meet.

The safety of passengers in the air, on land and sea; the pleasure of large audiences; the enjoyment of radio and television at home; all depend on the efficiency of communication systems, an efficiency which has been accomplished and continues to be promoted by constant consultation with Lord, HQVC (Headquarters for Vibration Control).

LORD
SHEAR TYPE
Bonded Rubber
MOUNTINGS



IT TAKES BONDED RUBBER *In Shear* TO ABSORB VIBRATION

LORD MANUFACTURING COMPANY
ERIE, PENNSYLVANIA

SALES REPRESENTATIVES
NEW YORK . . . 280 MADISON AVE.
CHICAGO . . 520 N. MICHIGAN AVE.
DETROIT . . . 7310 WOODWARD AVE.
BURBANK, CAL. . 245 E. OLIVE AVE.
CANADIAN REPRESENTATIVES
RAILWAY & POWER ENGINEERING CORP., LTD.
TORONTO, CANADA

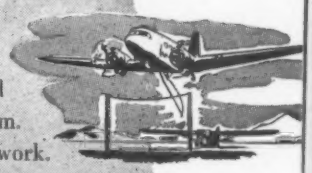
Originators of Shear Type Bonded Rubber Mountings

Every genuine Lord Mounting carries the name "LORD" embossed in the rubber or in raised letters on the forgings.

In Springs— it's the X-Dimension that gives a Glider and You a Lift

Ever hear of the X-Dimension of a Spring? Probably not. But, sure as you're born it's there, in every spring. Take, for instance, the intriguing what-is-it pictured below. It's a glider release spring, an assembly which holds the pick-up rope until the parent plane hitches on—then let's go at a precise jerk on the towline.

If Hunter had only manufactured and delivered dependable glider release springs on time and in needed quantities, its job would have been satisfactory. But Hunter invented the device for All American Aviation, Inc., and assigned the patents to them. That's the X-Dimension at work.



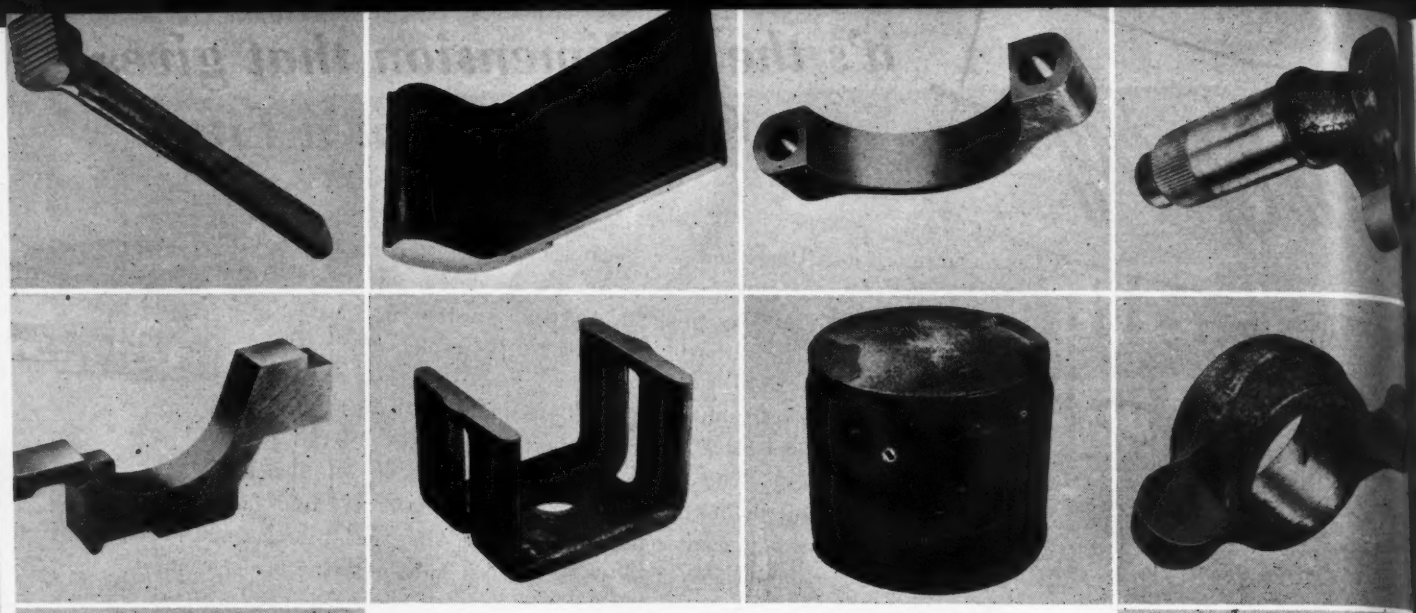
It's also at work in such pioneering efforts in spring manufacture as control gaging and statistical methods in quality control. It's your guarantee of good springs, your insurance against failures and customer complaints. It's *more* than you bargained for—in springs.

HUNTER
Science in Springs

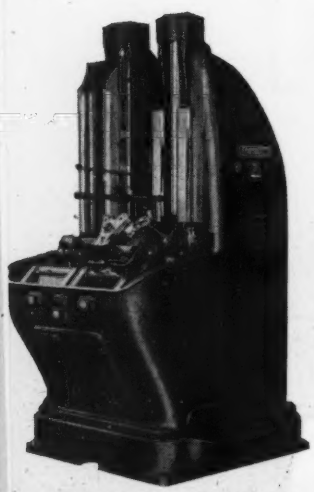
HUNTER PRESSED STEEL COMPANY
Lansdale, Pennsylvania
SPRINGS • METAL STAMPINGS • WIRE FORMS
MECHANICAL AND ELECTRICAL ASSEMBLIES

MEMO TO PURCHASING MEN—

• Next time your engineers hand you a tough spring procurement job, let Hunter help you get your money's worth.



LOWER machining costs with *Surface Broaching*



10-Ton Duplex Surface Broaching Machine with tilting tables. Also furnished in 5-Ton, 15-Ton and 25-Ton sizes.

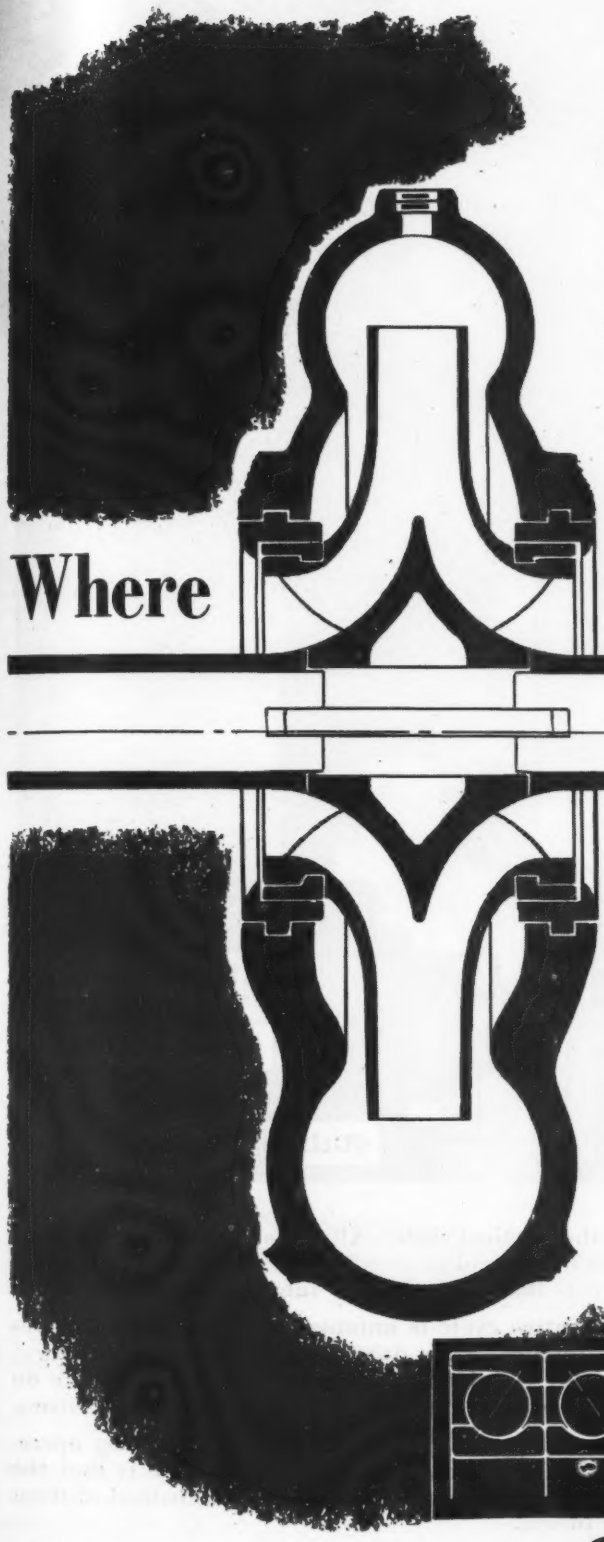
Many types of work can be surface broached on Footburt machines at remarkable savings over previous machining methods. High production is obtained with required accuracy and finish. Holding fixtures are designed for quick, convenient loading. Cutting tool maintenance costs are low. If you have a part that you think can be surface broached, send blueprints and production requirements. We will be glad to make our recommendations on Footburt Surface Broaching Machines based on our many years of experience in handling similar work.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: General Motors Building

Footburt Patented Tooth Form

FOOTBURT *Surface Broaching*



A TIGHT-SPOT with a drive shaft . . . that's a centrifugal pump. It's necessary to fit the rotating element that does the pumping so closely inside the housing that clearances are extremely minute. That's how you get suction and it's also how you can get into trouble if there's end-play in the drive shaft. Only ball bearings can take that combination of heavy radial and thrust load and high speed and hold vital clearances.

Where End-Play is FOUL PLAY

It's Fafnir's job to take on tough jobs like this . . . and come up with a series of bearings such as the Duplex Units. Their greater ball complement and double angularity of load lines enable these bearings to take heavy loads with the ultimate in axial and radial rigidity. They maintain precise clearances between rotary element and casing, require minimum attention and last long beyond anticipated life expectancy.

It's the way Fafnir enters into working partnership with machine designers and machine users in offering practical solutions to any bearing problem that makes so many executives say, "Let's put it up to Fafnir." The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

Lo-swing IMP SLASHES TURNING COSTS ON AUTOMATICALLY LOADED RING JOB

Problem: To automatically load and unload, rough turn, finish turn and chamfer the outside diameter of Valve Seat Rings.

Solution: The IMP Automatic Lo-swing Lathe selected for this job was equipped with the Seneca Falls Ram Type Loader used successfully on many types of small parts with a substantial reduction in manufacturing costs.

Rings are loaded in the hopper (shown in above illustration) and are automatically picked up and placed on the air operated collet by the work injector.

Two carbide tools on the front carriage rough and finish turn the outside diameter while one edge is rounded and the other chamfered by two tools set on the vertical slide. All tools then withdraw, pressure on the collet is released, and the work ejector thrusts the finished piece into the unloading chute.

The entire cycle is automatic; the spindle revolves continually—even during loading and unloading—thereby reducing starting and stopping fatigue on the motor, pulley, belts and other drive mechanisms.

A similar tool layout is used for the boring operation on these rings; the only difference is that the piece is held on its outside diameter instead of from the inside.

Seneca Falls Engineers have vast experience in the successful designing of automatic loading equipment for all types of Lo-swing Lathes. Why not let them solve your postwar machining problems?

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

LATHE NEWS from SENECA FALLS

Now! CHECK BORES FASTER more accurately

NO PILOT NECESSARY

DuBo

SINGLE END
Sizes 1.510" to 6.010"
(38mm. to 152mm.)

DOUBLE END
Sizes .240" to 1.510"
(6mm. to 38mm.)

PATENTS PENDING

...that New, Better PLUG GAGE by STANDARD

HERE is a radical improvement over old-style, limit plug gages. DuBo is designed for greater ease - in - use, finer precision, more thorough inspection, faster gaging. Its unmatched lightness and balance give finger-tip control and amazing sensitivity in revealing internal bore conditions ordinarily passed over by common cylindrical plug gages.

Write for Special Bulletin.

DuBo Tells More...More Easily

Spherical gaging surface, chamfered, relieved and self piloting, enables DuBo to be inserted easily into bores of extremely close tolerance.

Out-of-roundness, taper, belling and dimensional deviations revealed by unmistakable tilt of handle.

May be used in deep bores and close to the bottom of blind bores.

Finger-tip "feel" and control reveal internal conditions at any point in the bore. Light weight minimizes fatigue.

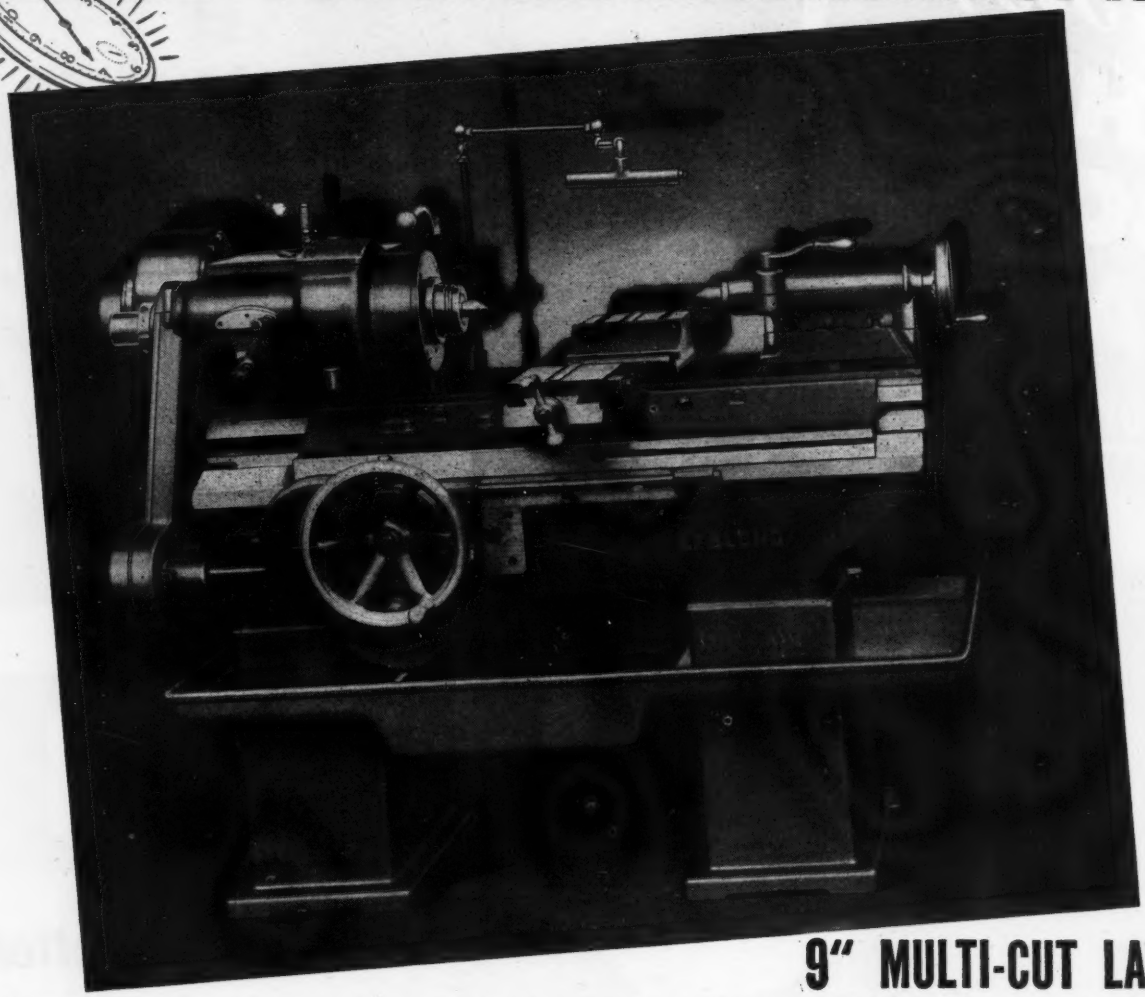
Plastic color signals, Green for Go, Red for Not Go, make identification easy, prevent errors in reading.

Chamfered edges automatically wipe bore and help prepare a clean surface for accurate gaging.

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

PRECISE ENGINEERING FOR PRECISION PRODUCTION

TO HELP YOU IN THE RACE AGAINST TIME



9" MULTI-CUT LATHE

PRODUCTION is always a race against time. Machines and tools that save time, cut costs. And reduced costs assure better profits. All LeBlond Lathes are designed and built to provide you with this time-saving, cost-cutting element so necessary to profitable production.

An excellent example of built-in production economy is the LeBlond Multi-Cut Lathe. It provides practically unlimited tooling possibilities, but at low tooling cost. The set-up is simple. And from then on the operator simply loads and unloads the machine and engages the feed levers. One operator can handle two or more of the Multi-Cut Lathes at once, depending on the length of cutting time. The LeBlond Multi-Cut Lathe, with its many tools cutting simultaneously, cuts the number of operations—cuts spoilage— cuts man hours . . . provides you with the functionally correct means to produce at a better profit. Available in 6" and 9" sizes.

★

SINCE 1887

the world has been turning to LeBlond for turning equipment.

★

WRITE FOR CATALOG!

TO HELP YOU RECONVERT

Our field engineers are at your service to help you in your development work, particularly along the lines of the difficult, the "out-of-the-ordinary" turning problems. We offer you the accumulated knowledge of every manufacturing trend in good times and bad—war and peace—gained over a period of nearly 60 years from thousands of installations all over the world. Contact our nearest dealer or write Dept. FE 46.

THE R. K. **Le BLOND**

ARMY E NAVY KEEP BUYING BONDS AND KEEP THEM

MACHINE TOOL CO., CINCINNATI 8, OHIO, U. S. A.

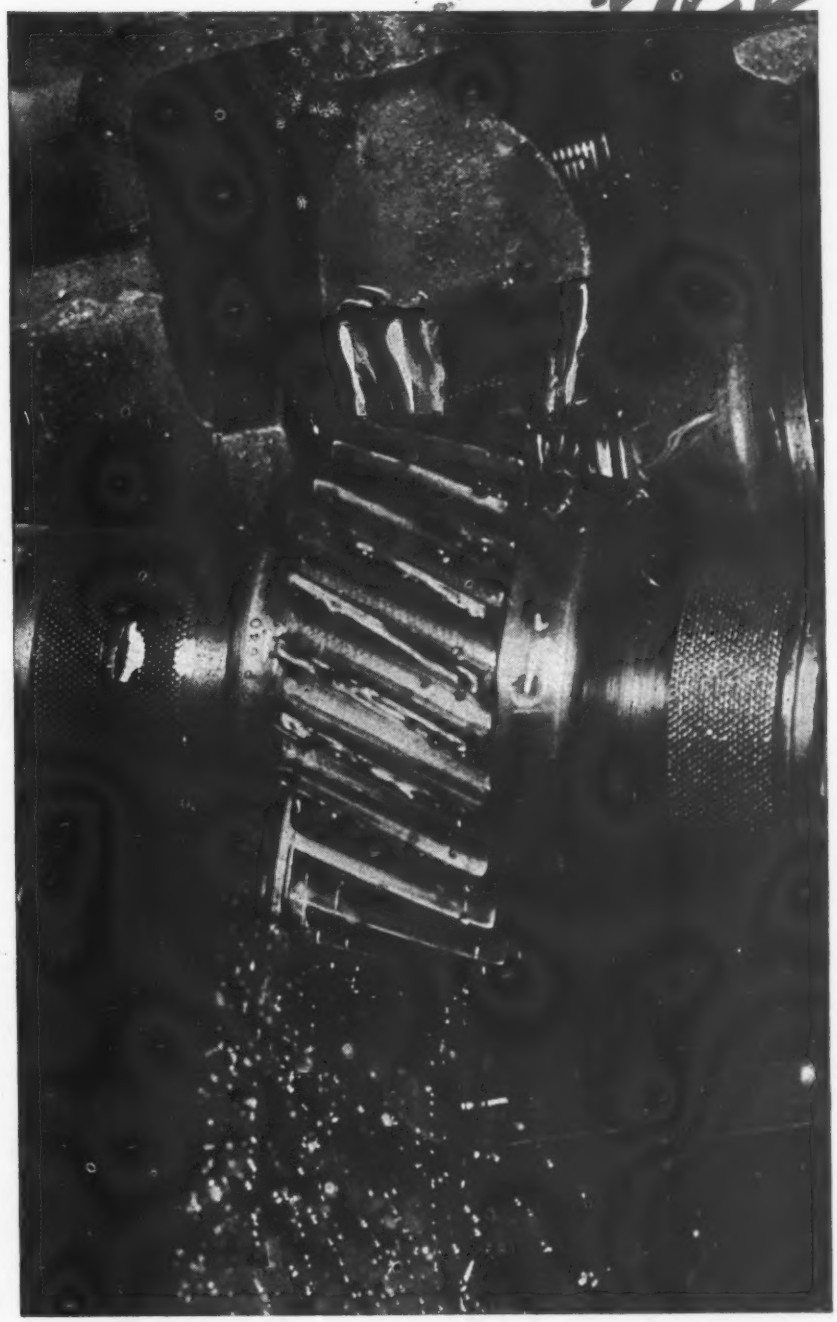
NEW YORK 6, Singer Bldg., 149 Broadway, WOrth 2-0722

CHICAGO 6, 20 North Wacker Drive, STA 5561

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

Specify S/V Sultran Cutting Oils for...

GEAR SHAVING ACCURACY AND FINISH!



WHERE GEAR SHAVING is employed to obtain superior finish and great surface accuracy with greatest economy, it pays to get additional cutter protection from the highest quality cutting fluids that you can buy.

You can get this protection with S/V Sultran cutting oils. In many shops across the country, these outstanding oils are proving their superiority in protecting gear shaving cutters. Here's why:

S/V Sultran cutting oils possess exceptional oiliness properties, the characteristic most needed for gear shaving operations. Operators who are using them report that they are obtaining phenomenal cutter life despite the naturally abrasive action of minute chips on the hundreds of cutting edges on each cutter.

For gear shaving and for other precision machining, be sure to specify S/V Sultran oils. Your Socony-Vacuum Representative will help you select and apply the exact cutting fluid for your individual job.

SOCONY-VACUUM OIL COMPANY, INC.
Standard Oil of N.Y. Div · White Star Div. · Lubrite Div. · Chicago Div. · White Eagle Div. · Wadhams Div. · Magnolia Petroleum Co. · General Petroleum Corporation of Calif.

GARGOYLE Lubricants

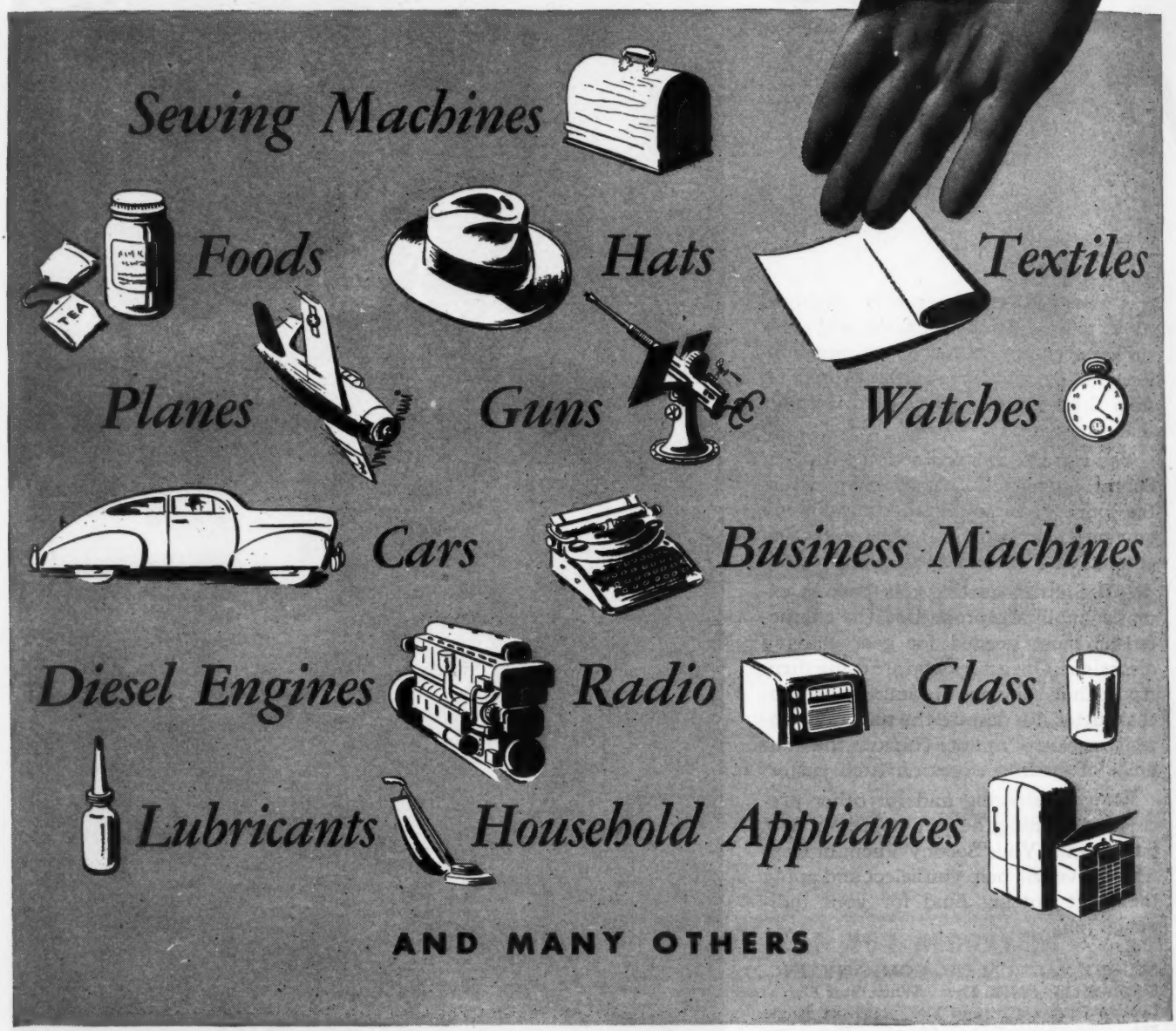
SOCONY-VACUUM'S 5 Steps to Lower Production Costs:

1. Lubrication Study of Your Entire Plant
2. Lubrication Schedules and Controls
3. Lubricant Storage and Handling System
4. Skilled Engineering Counsel
5. Progress Reports of Benefits Secured

TUNE IN "INFORMATION PLEASE"—MONDAY EVENINGS, 9:30 E.S.T.—NBC

You can draw on 70 Years of TAFT-PEIRCE Experience

IN TOOLING AND PRODUCING



At one time or another, every basic industry has been served by The Taft-Peirce Contract Division in one or all of its phases: Engineering, design, redesign, model-building, tooling, building of special machines or parts, and finally the production of any quantity, large or small, of parts or complete mechanisms and products. Come V-J Day, all this varied experience will be at your service again, implemented as always by the top-grade men and machines traditionally associated with The Taft-Peirce Manufacturing Company of Woonsocket, Rhode Island. Many departments have available capacity at present. Preliminary arrangements may be discussed now, if you like, so that you may satisfy yourself as to what so many industrialists mean when, *speaking frankly out of their own experience,* they give you this advice:

For Design, Tooling, Contract Manufacturing . . .

TAKE IT TO TAFT-PEIRCE

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

A technical magazine states that the war-developed arc-oxygen electrode will cut quarter-inch steel plate at the rate of a foot per second while under 40 feet of water. *Metal and Thermit Corp.*

get ready with CONE for tomorrow

It is estimated that within a few years 80% of the coal mined underground will be removed from the mines on conveyor belts instead of in cars. *Scientific American.*

get ready with CONE for tomorrow

The PV-3 helicopter has a long fuselage with a rotor on each end and carries twelve persons. It is being tested by the Coast Guard and Navy. *Popular Science.*

get ready with CONE for tomorrow

A new cement, for use in concrete flooring, is said to drive away insects, kill bacteria, and prevent the formation of molds. It also dissipates static electricity. *H. H. Robertson Co., Pittsburgh.*

get ready with CONE for tomorrow

An appliance manufacturer announces an electric washing machine that can also, by the use of attachments, wash dishes, peel potatoes, churn butter, and freeze ice cream. *Hurley Machine Division Elec. Household Utilities.*

get ready with CONE for tomorrow

A new gasoline-powered lawn mower resembles a floor scrubbing machine. It is mounted on four wheels and uses a rotary knife revolving at 3,000 r.p.m. *Whirlwind Lawn Mower Corp., Milwaukee.*

get ready with CONE for tomorrow

The manufacturer of the jet engine used in the P-80 Shooting Star prophesies that all transcontinental planes will be jet-propelled within five years. *General Electric.*

One of the war devices that may survive to help the motorist is the tire gauge that registers on the dash, developed for the Army's amphibious "duck." *GMC Truck and Coach Div.*

get ready with CONE for tomorrow

A magnetic survey of the state of Florida shows large areas in the southern part that are favorable for the occurrence of petroleum. *U. S. Dept. of Mines.*

get ready with CONE for tomorrow

Meals are being served in the Naval Air Transport Service that are pre-cooked, packed in a covered paper plate and frozen. On the plane they are thawed and heated in a special oven. *Maxon Sky Plate, W. L. Maxon Corp., 460 W. 34th St., New York.*

Air conditioned trolley cars are being introduced in a Southern city. This is said to be the first use of such equipment in city vehicle transportation. *Atlanta, Ga.-Pullman-Standard.*

get ready with CONE for tomorrow

A new household electric light switch can be set for delayed action up to three minutes. *T. J. Mudon Co., 1240 Merchandise Mart, Chicago.*

get ready with CONE for tomorrow

Rubber V-belts molded around a steel cable have been developed to replace chain drive on Army motorcycles. *Goodyear, Akron 16, Ohio, Whizzer Motor Co., Los Angeles.*

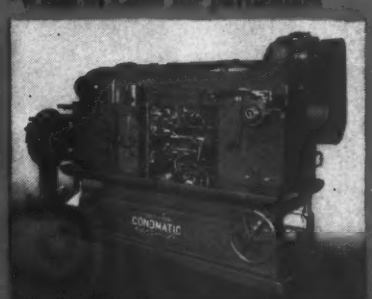
get ready with CONE for tomorrow

Even the common wire nail has been improved. The new type has a notch in place of the point and is claimed to be non-splitting. *E. S. Gair, Snyder, New York, inventor.*

15 *operations in 12 seconds*

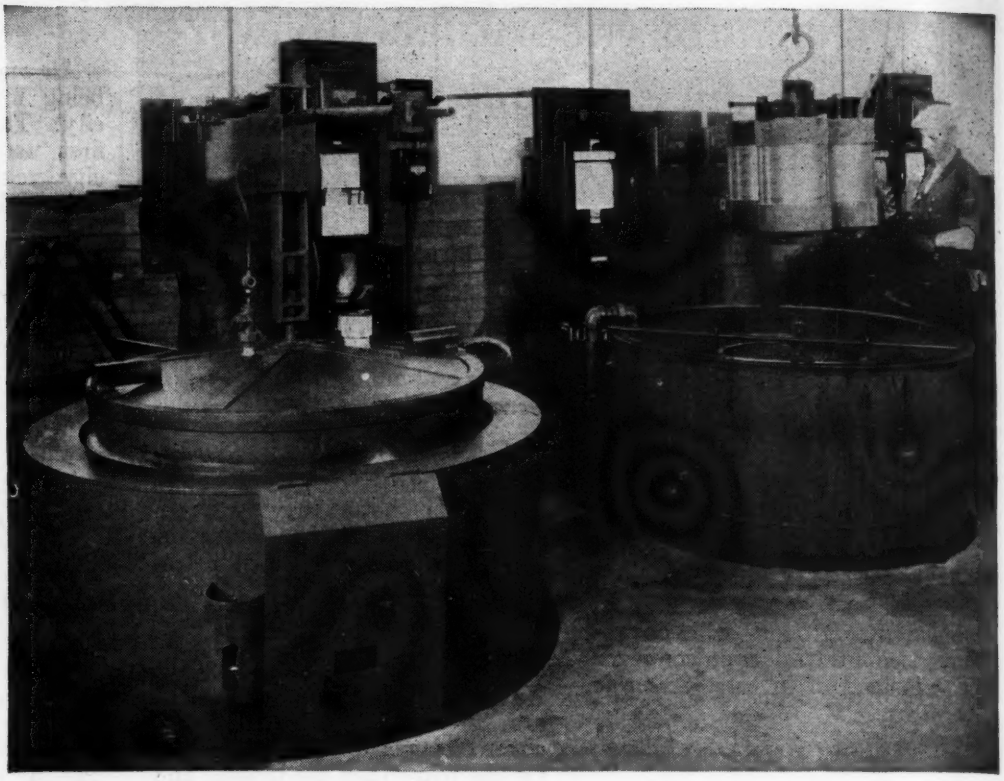
The 15 operations that form this washing-machine part of B-1112 steel, including rolling the oil groove* in the outside diameter, are performed by the 8-Spindle Conomatic in 12 seconds.

*Write to Cone for particulars



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.



Three 600-lb pins for a "Nordberg" Diesel engine, on the way to be loaded into Homocarb Furnace in foreground. Pins will be carburized to a uniform depth of 0.090", slowly cooled, reheated in the Homocarb Furnace and quenched. Nordberg Mfg. Co., Milwaukee, uses two Homocarb Method equipments for this, and similar work.

CARBURIZING'S War Record Points to Peacetime Savings

As a cost-cutter and a production-increaser, the process of carburizing comes out of the war ready to help solve many problems in the design and manufacture of steel parts which require hard surfaces.

Carburizing was, of course, ready for widespread quality use in the late 1930's, but its quality possibilities were not particularly well known. Enormous use in war work was the fact which proved on a wholesale scale that quality and quantity can go hand in hand in carburizing.

Mass-production carburizing of airplane engine parts, in big batteries of Homocarb Furnaces, shows suitability of Homocarb Method for high-quality high-production work. Photo courtesy Perkins Machine & Gear Co., Springfield, Mass.

A large percentage of all this high-grade, low-cost carburizing was and is done by the Homo Method of carburizing. For Homocarb gives full, easy and automatic control of the "furnace" factors in the process. There are four of these factors—Temperature, Time, Quality and Quantity of carburizing medium and Control of cooling speed under protective atmosphere. They are fully explained in our Catalog T-623, sent on request. If, however, you have a carburizing problem actively in work, we suggest you see an L&N engineer. And if you already have a Homocarb Furnace, ask about the new quick-cooling feature which can be added.

LEEDS & NORTHRUP COMPANY, 4921 STENTON AVE., PHILA. 44, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Jrl Ad T-623(20)

Volume 52 No. 4 MACHINERY DECEMBER 1945

Copper Furnace Brazing

In Recent Years, Copper Furnace Brazing has Become an Important Means for the Performance of Assembling Operations. This Article Reviews the Equipment and Methods Now being Applied in Large-Scale Industrial Operations

By GLEN A. ROBINSON, Metallurgist
North American Aviation, Inc.
Inglewood, Calif.

THIS article discusses the subject of copper furnace brazing in the light of experience in the aviation industry. Four principal phases are dealt with: (1) The application of furnace brazing and the results obtained; (2) furnace brazing equipment; (3) furnace brazing technique; and (4) the strength of brazed joints.

The information given is based on an extensive series of investigations undertaken at the plants of North American Aviation, Inc. Briefly, the following conclusions were drawn from these investigations: (1) Because of the simplicity with which complicated parts can be assembled and fabricated, it is certain that furnace brazing will be very extensively used in the future. (2) Furnace brazing equipment requires accurate time, temperature, and atmospheric controls. (3) Ample strength and a high percentage of completely bonded joints are the result of the present furnace operations.

Before entering on a discussion of the brazing furnaces and the brazing methods applied, some results obtained by this process will be men-

tioned to indicate the advantages that may be expected by the application of furnace brazing. In one instance, certain parts were formerly torch brazed at the rate of 6 an hour. Today, these parts are furnace brazed at the rate of 56 an hour, and the production cost has been reduced to 45 per cent of what it formerly was.

Assemblies that were previously cast or forged and machined are now stamped in the form of unit parts and brazed into assemblies with a marked decrease in production cost. For example, trigger guards that were formerly forged and machined are now stamped in thirteen pieces from cold-rolled strip, and copper brazed together. As a result, ninety-seven milling machines, sixteen broaching machines, and twenty-one profiling machines became available for other work, much less steel was required, and the production cost was reduced to about 16 per cent of what it formerly was.

Furnace-brazed joints have a uniform strength over their entire area. This is a definite improvement over spot-welding or riveting, where only a small area is joined at each spot. The average strength of copper furnace-brazed joints under various conditions has been found to be as follows: Tensile strength, from 30,000 to 56,000 pounds per square inch; shear strength, from 20,000 to 36,000 pounds per square inch.

Furnace-brazed joints can be depended upon to be air- and water-tight. In a recent test, only one air-pressure leak was found in 600 brazed assemblies. The joint in the leaking assembly was not completely filled, and should have been rejected by visual inspection methods. In another case, 660,000 tube joints were checked at from 275 to 300 pounds pressure per square inch and only twelve leaks were discovered.

Furnace-brazed parts are uniformly heated over the entire area, which prevents the localized distortion developed by flame- and induction-heating methods. Subsequent straightening or machining is generally not required. Some distortion caused by internal strains imparted during stamping, punching, or machining, and the expansion and contraction of parts when heated and cooled, is to be expected. The method of supporting the parts in the furnace can be so selected as to prevent sagging.

With proper precautions, the surface of the parts remains bright and free from decarburization, with no oxidized scale or flux-covered areas. The elimination of cleaning costs for finished assemblies is an additional saving. Parts that are to be hardened after brazing should be heated in an atmosphere similar to that used for furnace brazing, so that the parts will remain bright and free from decarburization.

Light-weight parts can be joined to heavy pieces and steels of different compositions can be joined together without danger of joint stress or cracking.

Parts maintain inherent balance after brazing. The surface copper outside the joint can be easily removed by cyanide deplating methods.

The uniformly tough copper-covered joints are resistant to vibrational and impact fatigue, which means a marked saving in service costs. One instance is on record where parts, when riveted, would withstand an average of 1,400,000 operational impacts. When furnace brazed, the same parts withstood 5,300,000 impacts.

Glen A. Robinson, the author of this article, has had experience in various engineering and chemical fields, acquired while working with the Utah Power and Light Co. and the Utah Copper Co. At the beginning of the war, he was process engineer with the Remington Arms Co., and later became metallurgist in charge of

the material acceptance department at Remington's gun plant at Ilion, N. Y. Since September, 1944, he has been employed as metallurgist in the production development laboratory at the Inglewood plant of North American Aviation, Inc. He has a B.S. degree in chemical engineering from the University of Utah.

The furnace brazing process leaves the parent material in an annealed condition, completely free from internal stress and with a uniform structure which may be satisfactorily heat-treated.

Either silver or copper can be used for joining plain carbon steel materials. Stabilized stainless steel has not yet been brazed satisfactorily, but this will be investigated later.

Furnace-brazing methods allow for a smaller designed section, which reduces inertia and space requirements. Car-clutch gear-bearing retainers were formerly cast and machined to a weight of 1.5 pounds. Furnace-brazed assembly methods reduced the weight to 0.5 pound and decreased the space displacement by 50 per cent.

Types of Brazing Furnaces

Furnaces vary in size and heating capacity in accordance with the rate of production required and the weight, shape, and size of the assemblies. Fig. 1 shows diagrammatically a box type furnace in use at one of the North American Aviation plants. Fig. 2 shows another type of furnace, which can be either hand-operated or provided with an automatic feed. Fig. 3 shows a mesh-belt conveyor type brazing furnace.

All these types of furnaces can be used for furnace brazing with copper at from 2050 to 2100 degrees F. or with silver alloys at from 1300 to 1400 degrees F. The operator must time the work, so as to see that the parts are in the heating chamber sufficiently long to insure complete joint filling, and that the parts remain in the cooling chamber long enough so that their temperature is not over 300 degrees F. when they are removed into the air. Higher temperatures cause discoloration and scaling of steel when in contact with air or moisture.

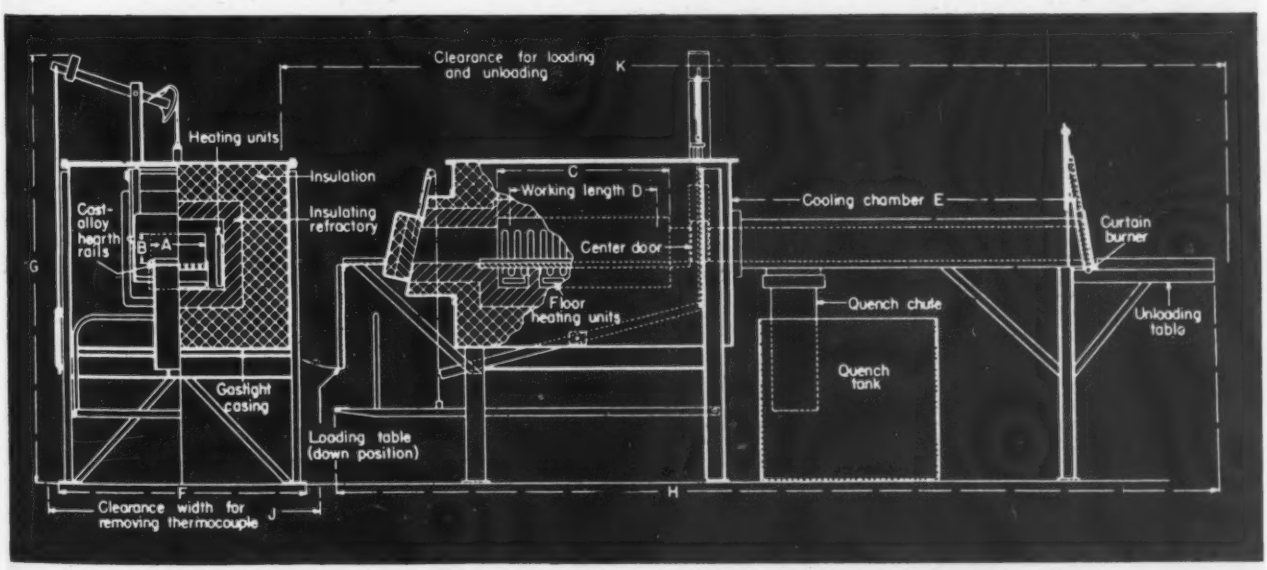
The heating chamber of the furnace at the North American Aviation plant is lined with alumina insulating refractory, brick-backed by a gas-tight sheet-steel casing. Electrical heating units are mounted in the roof and floor. Conveyors, rollers, and push-rails are made of heat-resisting materials, such as Inconel or Nichrome.

Cooling Chambers

Various cooling chambers are devised depending on the type of treatment the parts require. For bright annealing, the length of time the parts are held in the water-cooled chamber is about four times as long as the time required to braze the joints. Both cycles increase with the mass of the parts being treated.

The hardness of parts and the length of time necessary for them to be held in the cooling chamber can be varied by regulating the cold water flow in the cooling jackets. Automatic controls hold the temperature between 100 and 160 degrees F. for bright annealing. Faster

Fig. 1. Box Type Furnace for Copper Brazing in Use at a Plant of North American Aviation, Inc.



cooling causes excessive warpage and discoloration of the parts. Slower cooling increases the time the parts are exposed to the slight traces of carbon dioxide and water in the cooling chamber, with an increase in decarburization.

For normalizing, parts are moved quickly through the cooling chamber and cooled in the air. This method causes discoloration and scaling during air cooling. For scale-free hardening, hinged-bottom trays are used which open through a quench chute in the cooling chamber, allowing the parts to drop into oil or water.

Automatically fed furnaces are provided with variable speed adjustment. Once the required feed rate is determined for the parts being treated, a continuous flow of bright annealed parts is removed from the furnace. In hand-operated furnace types, the parts are pushed into the cooling chamber and moved in from three to five equally timed steps toward the outlet, where they are removed at a temperature below 300 degrees F. The longer the cooling chamber, obviously the longer the cooling time for trays in continuous operation.

Temperature Control Apparatus

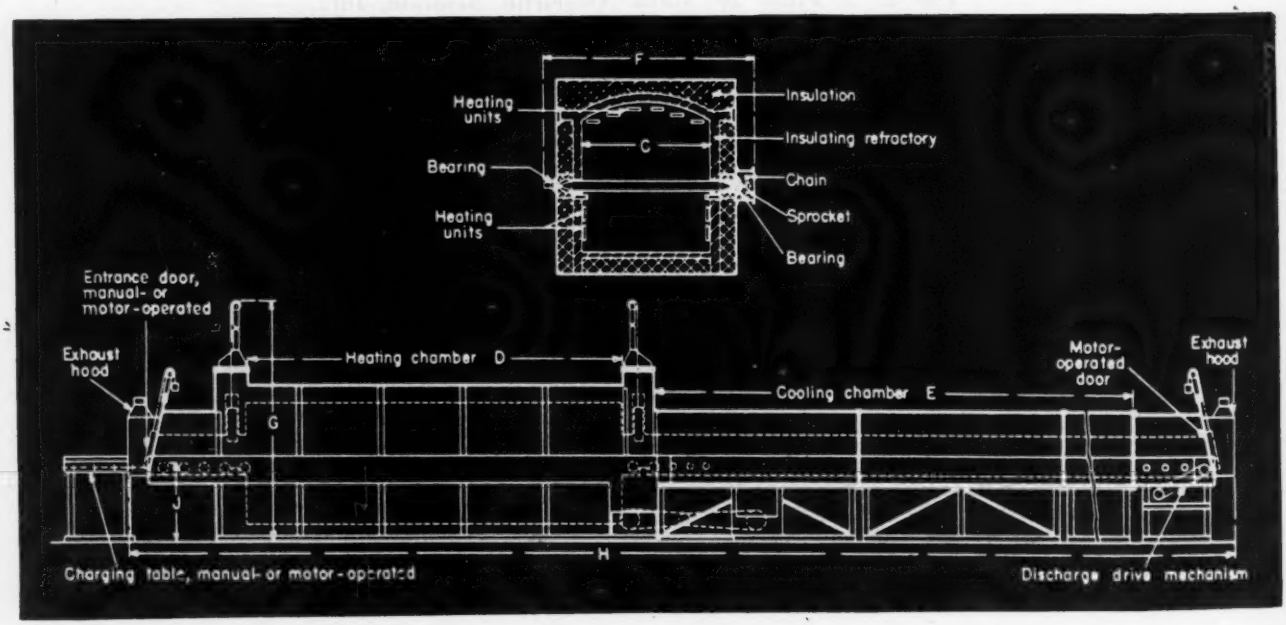
A thermo-couple of one nickel and one molybdenum wire is connected to the furnace leads of copper-constantan which connect with a Micromax pyrometer control and a Thyratron tube, which controls the rectified direct current in a reactor. The reactor, in series with the furnace heating units, varies the alternating-current voltage, and hence the power applied to the electrical heating coils of the furnace. The temperature may be accurately held at any point between 900 and 2100 degrees F., and is recorded by the Micromax on a chart.

The amount of "atmosphere" required depends on the size, capacity, and door openings of the furnace. The atmosphere is composed of carbon monoxide, nitrogen, and hydrogen. This mixture is produced by equipment that is now commercially available.

Distance that Copper will Flow within Joints

"Copper brazing" is the term applied when copper is placed near a steel joint and heated to 2050 degrees F., at which time the copper is drawn into the areas to be joined by capillary attraction. The distance that the copper will flow to fill joints of various widths has been investigated. In one instance, two pieces of cold-formed steel, 9 inches long by 2.5 inches wide, were fastened together so that there was a gap 0.050 inch wide at one end and no clearance at the other end.

Fig. 2. A Roller-hearth Type Brazing Furnace which can be Either Hand-operated or Provided with Automatic Feed



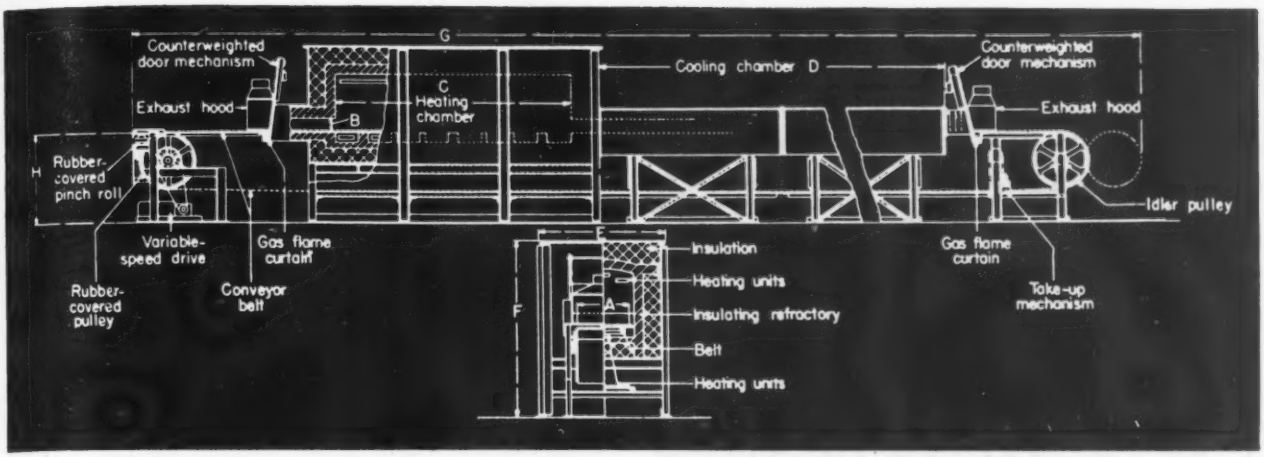


Fig. 3. Mesh-belt Conveyor Type Brazing Furnace

This assembly was then stood on edge and an excess of copper was placed along the bottom of the joint, so that the copper was required to rise by capillary attraction to fill the gap. The whole assembly was then heated to 2100 degrees F. for nine minutes and the joint examined. The copper had filled the entire 2.5-inch distance where the joint space was less than 0.030 inch.

This test showed that, for all practical purposes, loose fitting joints are easily filled with copper. However, the shear strength of the bond formed between parts spaced over 0.006 inch apart depends on the copper alone, and should not be estimated at more than 20,000 pounds per square inch of bonded area.

When pure copper is used for joining, there is an alloying action of the copper and iron within the joint, which increases the strength. The dark area within the joint shown in Fig. 4 indicates the alloying bond formed with copper and iron. The use of sand-blasted parts or copper containing silicon should be avoided, as small quantities of silicon cause a marked decrease in the strength of the joint. Table 1 gives an indication of this. (Data by Hanson and Ford, General Electric Co.)

Method of Locating and Spacing Parts for Brazing

Several methods are used to position the parts for assembly. Parts may be spot-, tack-, or projection-welded into position, or they may be force-fitted into position. The best method for force-fitting into holes and for guaranteeing the desired clearance for the copper flow is to use a machined surface on the male member and have the outside diameter 0.001 inch per square inch of joint surface larger than the hole. Other methods for positioning parts are swaging, expanding, peening, crimping, riveting, wedging, and the use of screws, winding fins, and interlocking joints. Some parts require special fixtures to hold the members in position for brazing. The shape and size of the part govern the choice of attaching methods. Stamped parts must be made so that the surfaces being joined are flat. All round edges should be avoided.

Effect of Steel Surface on the Strength of Joint and Flow of Copper

The surface of the material at the joint affects the bond strength and the rate and distance that the copper will flow into the joint. Within certain limits, however, this effect is negligible. Tests have shown that plug and ring joints with a surface roughness of 40 micro-inches r.m.s. had a shear strength of 35,420 pounds. When

Table 1. Strength of Copper and Copper Alloys

Material	Tensile Strength, Pounds per Square Inch
Copper with 5 per cent silicon.....	20,000 to 30,000
Pure copper, annealed	30,000 to 35,000
Copper with 2 to 5 per cent nickel..	45,000 to 48,000
Copper with 0.06 per cent iron.....	32,000
Copper with 0.40 per cent iron.....	34,000
Copper with 0.96 per cent iron.....	35,000
Copper with 1.50 per cent iron.....	43,000
Copper with 1.80 per cent iron.....	44,000
Copper with 2.09 per cent iron.....	49,000

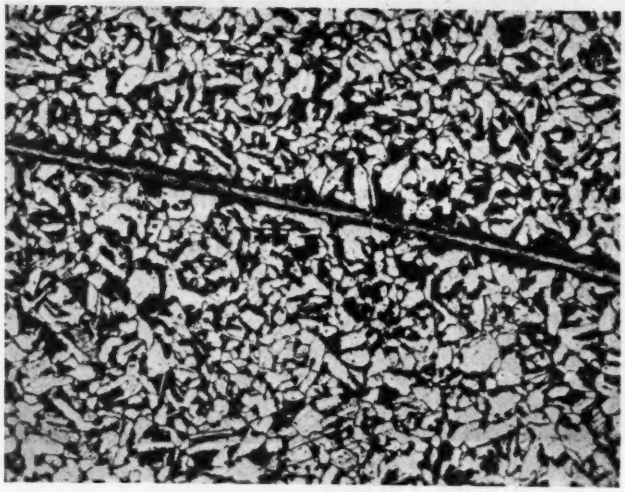


Fig. 4. Micrograph of Copper-brazed Joint, Showing Copper Bond; 100X Magnification

the surface roughness was 100 micro-inches r.m.s., the average strength decreased to 34,170 pounds, and when the surface roughness was 250 micro-inches r.m.s., the strength decreased to 33,330 pounds per square inch. It may be noted from this that the increase in depth of scratches above 40 micro-inches r.m.s. decreases the strength of the bonded joint only slightly.

Copper flows fastest and farthest on surfaces having scratches about 250 micro-inches deep, but where there is good capillary attraction inside joints, there is little difference between rough-machined, fine-machined, and ground surfaces having a roughness of from 50 to 500 micro-inches deep. For highly polished surfaces having scratches smaller than 20 micro-inches deep, the wetting reaction is retarded and little flow is obtained.

The surface must be free from dirt, grease, and rust. Surfaces within the joints are not as easily cleaned by the atmospheric reducing reactions as the exposed area, and some trouble may be experienced in obtaining a good bond. Also, rust reacts with the furnace atmosphere to produce carbon dioxide which causes decarburization. Parts on which scale has been formed by cooling from high temperature in air, oil, or water will be reduced by the brazing atmosphere, with the result that carbon dioxide or water will be formed and decarburization will take place. Parts should be thoroughly degreased with trichlorethylene, and if rust or scale has formed, they should be pickled or shot-blasted before assembling for brazing.

Method of Applying Copper for Brazing the Joint

The amount of copper required to fill the joint depends on the area, spacing, and the waste flow outside the joint. The method of holding the parts on the trays and the location of the copper tend to regulate the direction of copper flow into the joint. Different shaped parts require special experimentation to develop the best jigs and positions for placing the copper. Parts are often loaded on trays in double- and triple-decked stacks. The copper may be placed on the joint in the form of special shaped wire of various sizes, copper washers, or wedges, or the molten metal may be sprayed on.

North American Aviation has a special forming machine for rolling the copper wire into the desired shapes, so that the wire fits firmly around one side of the joint. In all cases, care must be taken not to encircle the joint in such a way that copper flows over an air pocket entrapped within the joint. Such joints may appear to be satisfactory when subjected to a visual inspection, but will fail in operation. Too much filler metal will cause the copper to spread outside the joints and sometimes cause lumps to collect on the surface. Care must be taken to control the joint clearance closely, so that the amount of copper can be accurately regulated. The amount of copper should be decreased until all joints are filled with a slight excess.

Methods of Holding Parts for Brazing

Trays and permanent jigs are made from Inconel or Nichrome, both of which are nickel and chromium mixtures capable of resisting high temperatures repeatedly. These materials do not rust, scale, or absorb moisture or air. As previously mentioned, scale, rust, air, and moisture cause decarburization of the parts being brazed.

Porous asbestos, siliceous oxide, or oxide bricks which react to form carbonates were found by tests made by North American Aviation, Inc., to cause decarburization, because they release absorbed water, carbon dioxide, or oxygen. Bricks containing Portland cement are not practical because of the carbon dioxide formed. Compact jigs of tri-calcium alunite or carborundum are best, provided the calcium and magnesium oxides are practically eliminated. The amount of distortion during brazing is dependent somewhat on the method of supporting the parts

during the brazing operations. A study of the direction of warpage will indicate the type of holders required.

Distortion in Furnace-Brazed Assemblies

Most of the distortion is caused by the releasing of strains formed during punching, stamping, machining, and other cold-forming operations. However, because the entire part is heated to the same temperature, there is no localized heating distortion such as ordinarily occurs in flame- and induction-heating. Once proper jigs are designed, complicated shapes may be furnace brazed into assemblies with little warpage.

Parts leave the regular brazing procedures in an annealed condition. Harder structures may be developed by increasing the air cooling rate or by quenching in oil. Regardless of the hardness developed, the large grain size, which was developed at 2050 degrees F., remains in the steel. Subsequent heat-treating is required to refine this grain.

Time Required for the Brazing Cycle

The longer the parts are held at the 2050 degrees F. temperature, the larger the average grain growth, and with adverse furnace atmospheric conditions, the deeper the decarburization. Once the part reaches the brazing temperature of 2050 degrees F.. about three minutes is ample time for brazing joints up to 1 inch in length. The time necessary to reach this temperature is a function of the weight of the parts. Also, the time required to cool the parts to 300 degrees F., before removing them into the air, is a function of the weight. Table 2 is based on the practice developed at North American Aviation for heating and cooling parts in the copper brazing process.

More accurate data will be obtained when a transparent window is installed in the furnace door, so that the temperature of the parts and the flow of copper can be observed. If the parts are removed from the furnace at a temperature above 300 degrees F., the air moisture darkens the surface. As a test to determine the cause of this darkening effect, apply 20 per cent hydrochloric acid. If the dark area becomes clean without pitting, the part has been removed into the air at too high a temperature and a temper color has formed. If the area becomes clean but remains dull in color, with slight pitting, the part has been darkened by the presence of moisture in the furnace.

Table 2. Heating and Cooling Time for Copper Brazing Parts

Weight of Parts and Trays, in Pounds	Heating Time, in Minutes	Cooling Time, in Minutes Cooling Water 110 to 130 Degrees F.
100	30	120
65	20	80
50	15	60
25	9	36
10	7	28

Effect of Heat-Treatment on Joint Strength of Furnace-Brazed Assemblies

Assemblies that have been copper brazed are often hardened, and the effect of various hardening procedures on the strength of copper brazed tube and ring joints spaced 0.002 inch apart is shown by the following data collected by H. M. Webber (from General Electric data) some years ago.

Table 3. Effect of Heat-Treatment on the Strength of Copper-Brazed Tube and Ring Joints

SAE Material	Heat-Treatment	Shear Strength, Pounds per Square Inch
1020	1550 degrees F., water quench	41,000 to 49,000
6140	1600 degrees F., oil quench	26,000 to 45,000
4615	1550 degrees F., water quench	44,000 to 59,000
Drill rod	1425 degrees F., water quench	36,000 to 46,000
2315	1425 degrees F., water quench	31,000 to 45,000

There is no indication that joints are weakened by heat-treatment. In fact, there appears to be an increase in strength due to the hardening of the alloyed bond.

Decarburization of Steel during Copper Brazing

Samples from various assemblies were found in one test to have decarburized to a depth of from 0.006 to 0.010 inch. A great deal of decarburization was found when assemblies were run through the brazing cycle more than once and when larger samples were held in the furnace for long periods. The amount of decarburization was found to be a function of the time

that the parts were held in the furnace. A small sample run through the heating and cooling cycle twice had approximately the same amount of decarburization as a larger sample requiring a heating and cooling cycle equal in time to the two cycles of the smaller sample. These tests indicate that decarburization data could be obtained by running samples along with regular production without delaying production schedules.

A total of seventy-two samples were run through several furnaces from one to six times in some cases, in order to determine the decarburization in relation to longer furnace cycles. Generally speaking, a 27-minute heating period and a 108-minute cooling period would be the longest cycle used.

A considerable amount of decarburization was found on samples run through various furnaces. To minimize the decarburization, some plants using the catalyst bed atmosphere producers have installed a General Electric carbon-dioxide remover, a Pittsburgh Lectrodryer, and a cooling chamber to remove the water. In other instances, it was found helpful to overhaul the furnaces and atmosphere producers, cleaning out the atmosphere feed-lines and repairing all air and cooling-water leaks.

Tests made at North American Aviation indicated that most of the decarburization was formed in the cooling chamber. Parts removed directly from the heating chamber and quenched in oil showed little decarburization.

The decarburization was reduced, but not wholly remedied, by thoroughly examining both the heating and cooling chambers for leaks under air pressure. All joints showing any possibility of leaks were rewelded. Flame curtains were designed to cover the door opening when charging the furnace with parts to be brazed.

Changes in operating technique also prevented moisture from entering the furnace. The doors were opened only enough to allow the parts to enter the furnace and closed as quickly as possible. Care was taken to be sure that the back and front doors were not opened at the same time, causing a through draft.

Decarburization was further decreased in the charcoal type atmosphere producers by outlining a strict moisture-purging procedure for each new charcoal charge. The best charcoals were found to be the types containing the least moisture and ash. Charcoals with high ash content often clog the feed-lines, causing a decrease in the atmosphere produced.

A thorough investigation was made to determine all the chemical reactions causing decarburization during copper furnace brazing. With this information, several methods were devised which practically prevented decarburization at the North American Aviation plant. The author of this article will send a report covering this investigation to anyone in a position to make use of it.

Tool Engineers Plan Exposition

THE American Society of Tool Engineers will hold an exposition in Cleveland, Ohio, April 8 to 12 in conjunction with the annual meeting of the Society. Arrangements have been made for the use of the entire Cleveland Public Auditorium, which will make available approximately 250,000 square feet of space. This will be the fifth exhibit of production equipment and processes held by the Society.

The show is being designed with major attention to its educational and informative value for all engaged in the field of production. It will include machines and tools, materials for fabrication, materials-handling equipment, drafting-room supplies and tools, coolants and lubricants, gages, and pneumatic, hydraulic, and electrical control devices. Because of the importance of delivering finished products to the ultimate user in good condition, space will also be devoted to exhibits dealing with methods and materials for packing machines and tools for shipment. Further information can be obtained by addressing the American Society of Tool Engineers, Penobscot Bldg., Detroit 26, Mich.

* * *

The gearing industry, as represented by the members of the American Gear Manufacturers Association, showed an increase in volume of sales of 4 per cent for September, 1945—the last month for which complete reports are available—as compared with August. This report does not include turbine or propulsion gearing.

Hydraulic Strippers Facilitate Drawing of Thin Shells

An Ingenious Method of Removing Thin Drawn Shells from Punches without Causing Damage to the Work-Pieces

By HENRY F. HILD
Vice-President in Charge of Engineering
Proctor Electric Co.
Philadelphia, Pa.

WHEN the War Department discontinued its program of drawing 20-millimeter cartridge cases from steel at the time that the critical brass shortage was overcome during the war, there were millions of coined cups on hand from which it had been intended to manufacture the steel cartridge cases. Engineers of the Proctor Electric Co., Philadelphia, Pa., were able to salvage more than twelve million of these cups for the Government by devising methods for drawing them into stabilizer and flare tubes.

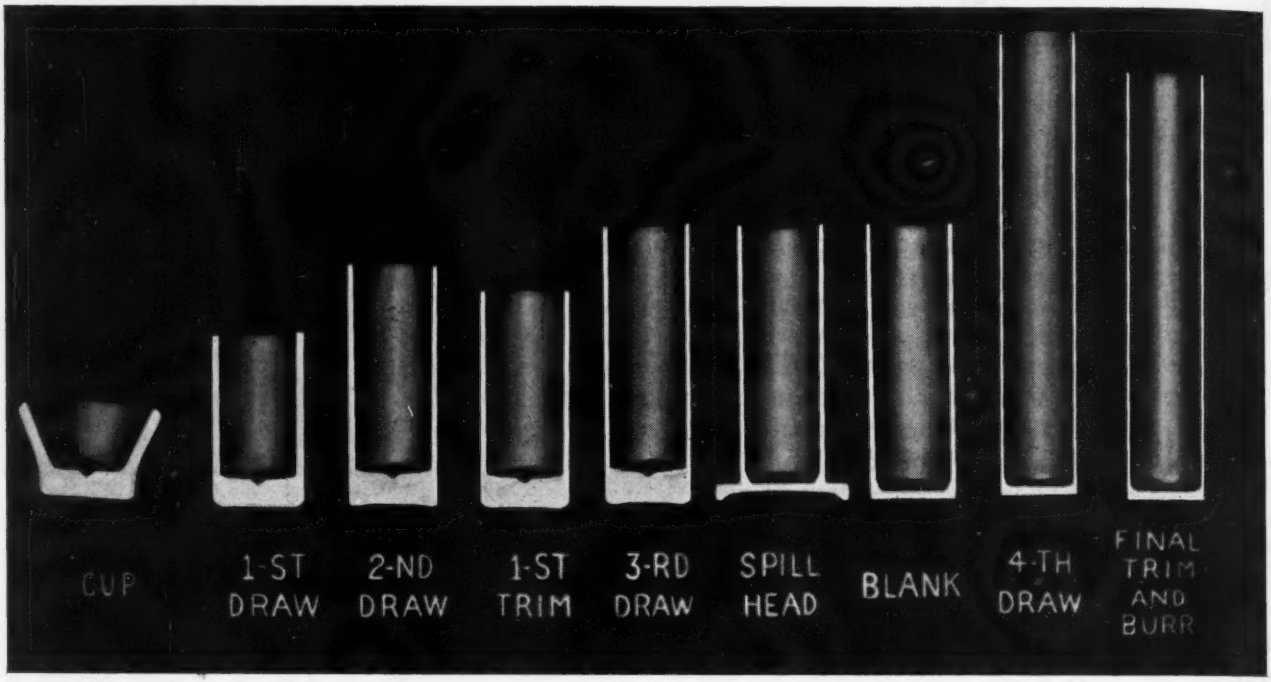
These tubes were produced with a wall thickness as little as 0.036 inch, a fact that presented insurmountable difficulties when attempts were made to strip the drawn shells from the punches with mechanical strippers. The thin shells became wrinkled and distorted around the top edge beyond economical salvage. To overcome this difficulty, hydraulic stripping means were developed, which not only insured removal of the work without damage, but enabled production to be carried out at the maximum operating speed of the presses. This article will outline in a general way the procedure followed in manufacturing the flare tubes, and will describe in detail the arrangement of one of the hydraulic strippers and also the design of an automatic work-feeding mechanism.

Nine stages in the manufacture of the flare tube are indicated in Fig. 1, which shows a cross-sectional view of a coined cup at the extreme left, and at the right of the cup, cross-sectional views of the tube as it appears after each successive manufacturing step. The dimensions of the part after each operation are given in Fig. 3. When the tubes are finished, the inside diameter must be within plus or minus 0.001 inch of the specified dimension for their entire length of 4.670 inches.

One of the ingenious steps in the manufacturing procedure was the method employed to reduce the original head thickness of the cup (0.310 to 0.330 inch) down to 0.070 to 0.085 inch. As no suitable equipment was available for machining off the excess material, the reduction was accomplished by heading the closed end in a die to form a flange 1 5/8 inches in diameter, as shown by the sixth example from the left in Fig. 1. This flange was later trimmed off, as indicated by the next view to the right.

The flange heading operation was performed

Henry F. Hild, the author of this article, is vice-president in charge of engineering of the Proctor Electric Co., Philadelphia, Pa. Mr. Hild is a graduate of the Drexel Institute of Technology with the degree of bachelor of science in engineering. He joined the Proctor Electric Co. in 1939 and was elected vice-president in 1944. Prior to his present connection, he was superintendent in charge of winding, impregnation, and assembly of by-pass condensers with the Philco Corporation, Philadelphia, Pa.; and general foreman of the Cornell-Dubilier Corporation, Plainfield, N. J.



on a knuckle press provided with an indexing table on which eight dies were mounted, as illustrated in Fig. 2. Each die was fitted with a central post which served as an anvil in striking the head of the flare tubes and acted as an ejector to lift the headed piece from the die when it approached the front of the press. The outside wall of the tube was confined in a die sleeve during the operation, which was recessed at the top to suit the diameter of the punch. The table was indexed in a clockwise direction at the rate of thirty-two times a minute in synchronism with the strokes of the press ram.

Only four drawing operations were performed in transforming the thick cups, 1 1/16 inches in height, to the thin shells, 5 3/8 inches in length, before the final trimming operation. Engineers consulted before the manufacturing methods were developed claimed that the job could not be done with only four draws because

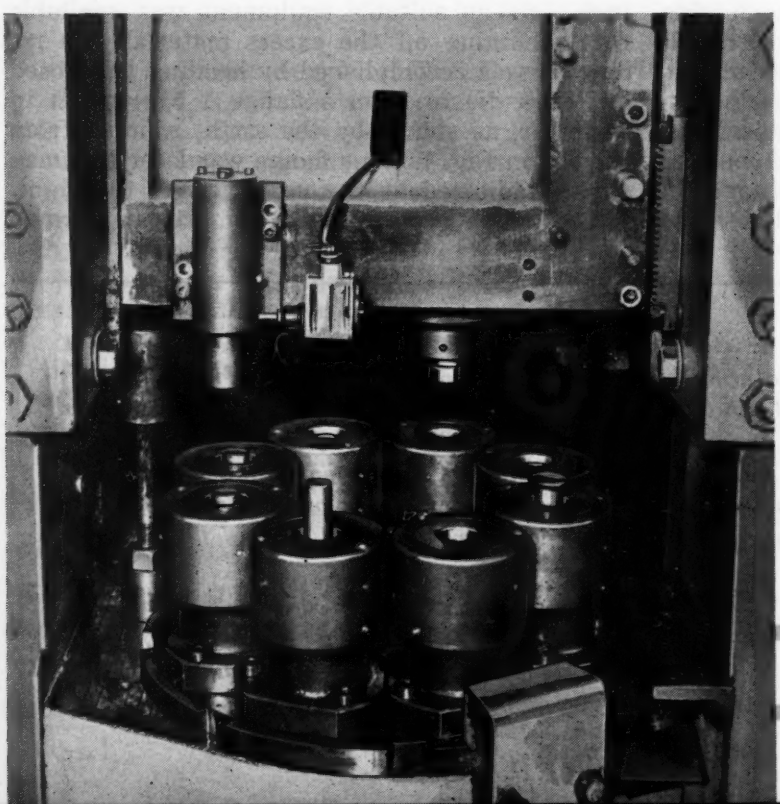


Fig. 1. (Above) Various Steps in the Production of a Steel Shell with an Extremely Thin Wall and Thin Head from Coined Cups Originally Intended for the Manufacture of 20-millimeter Cartridge Cases

Fig. 2. (Left) Punch and Die Set-up Devised for Heading a Flange on Thin Steel Shells preparatory to the Removal of Excess Material

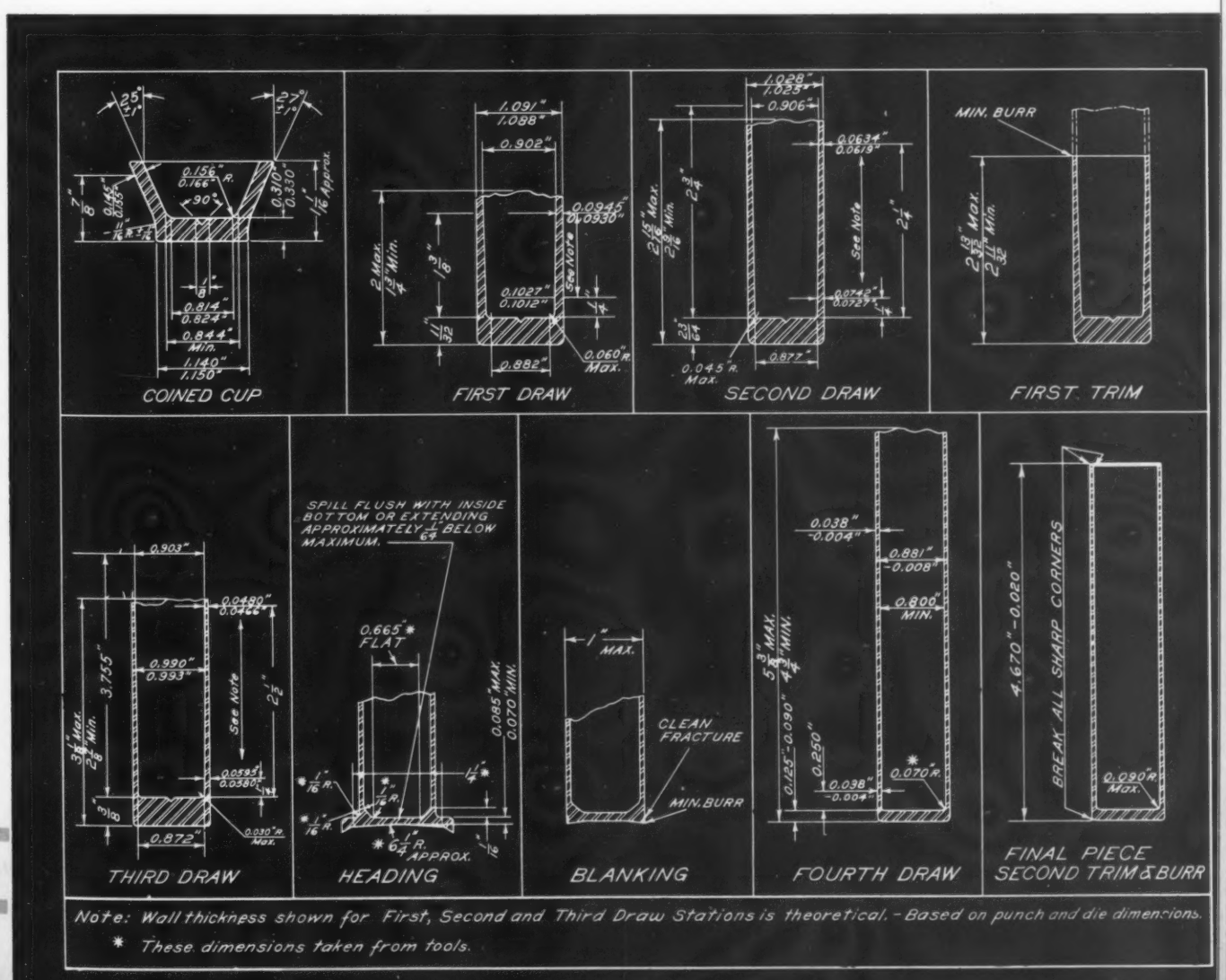
of the great amount of reduction that would be necessary—from 40 to 50 per cent in each case. The flare tubes were annealed after the cupping and after the second and third draws. The stabilizer tubes were annealed only after the cupping and the second draw. Annealing was performed at a temperature of 1250 degrees F. for a period of one hour and forty minutes in each case. The shells were coated before each draw with a soap solution of "Steelskin," which served as an efficient drawing lubricant.

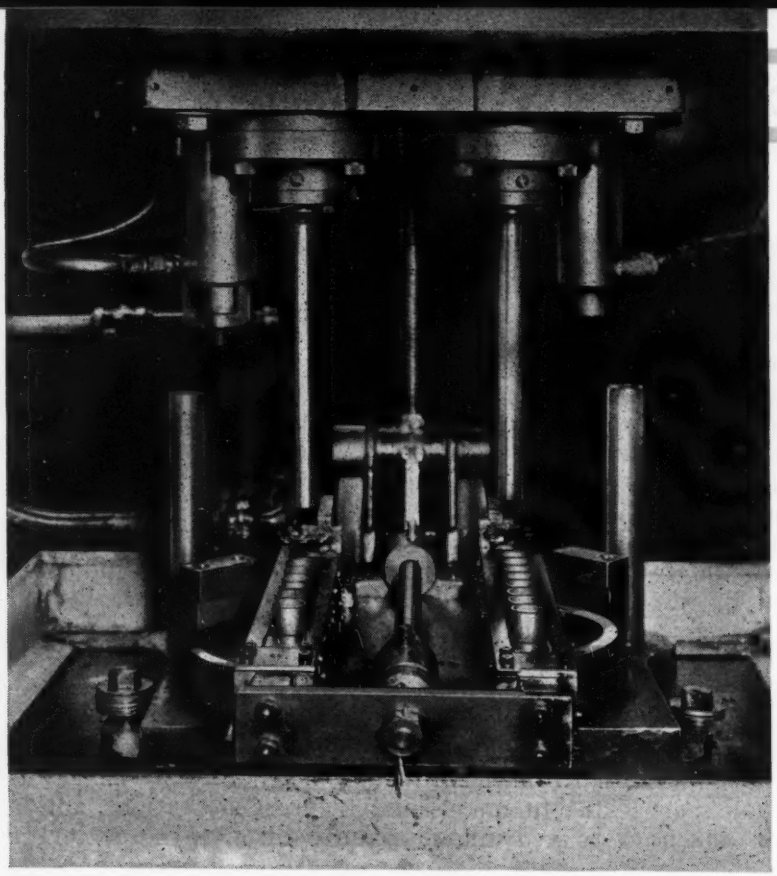
As a result of the working, unusually high physical characteristics were developed in the SAE 1025 carbon steel from which the cups were coined. An ultimate tensile strength of 100,000 pounds per square inch, and a yield point of 95,000 pounds per square inch were attained in the drawn shells although a yield point of only 80,000 pounds per square inch was specified. Elongation ranged from 9 to 10 per cent. These physical characteristics were much higher than were developed in making the 20-millimeter cartridge cases from the same coined cups.

Except for minor details, all four drawing operations were similar. They were performed in a die provided with a tungsten-carbide ring, as seen at *A*, Fig. 5, which was assembled into a tool-steel holder *B*. Punch *C* pushed the shell completely through the die. It was then ejected by the hydraulic arrangement before the punch again ascended. The position of the work in the die before the punch came down is indicated at *Y*. The work-pieces were automatically fed to the die with each up stroke of the ram. In Fig. 4 is seen a front view of a press equipped for the third draw, while Fig. 6 shows a rear view of the same installation.

With the hydraulic stripping arrangement used in each drawing operation, which is applicable to many similar press operations, oil is delivered under pressure through the center of

Fig. 3. Diagrams Giving Dimensions of the Shell in Fig. 1 after the Various Operations, beginning with the Coined Cup





the punch to the bottom of the shell. The pressure developed causes the shell to expand slightly away from the punch until it is sufficiently free so that the pressure can force the shell off the punch. Oil of a very light grade is employed in the hydraulic system. It is supplied at a pressure of 25 pounds per square inch from a central pumping installation which serves all presses equipped with the hydraulic stripping arrangement.

The oil is delivered to each press through pipe and rubber tubing to a cylinder *D* (Figs. 5 and 7), which is attached to the upper member of the die set, the die set, in turn, being mounted on the press ram. Two of these cylinders were provided on the press illustrated in Figs. 4 and 6 because this machine was set up with two sets of punches and dies. The oil enters each cylinder *D* through in-

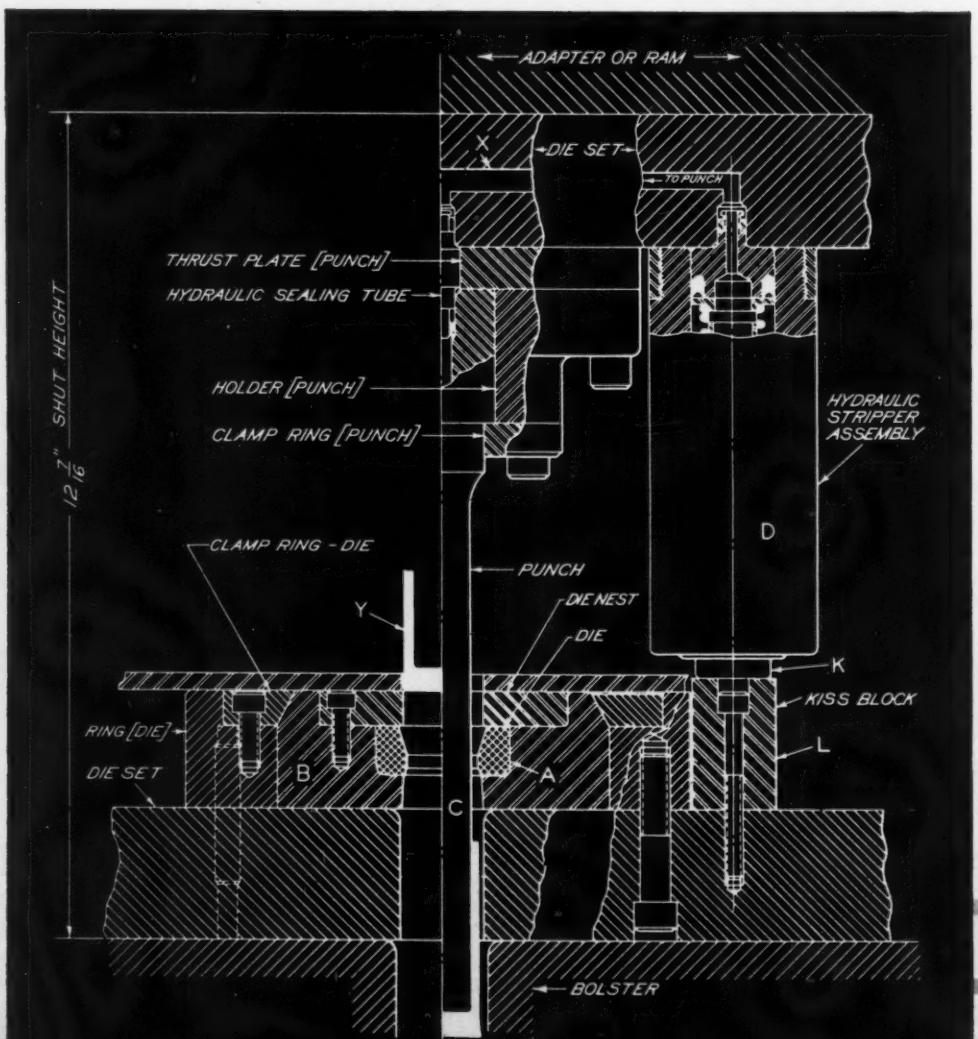


Fig. 4. (Above) One of the Power Presses Used in Producing the Thin-walled Steel Shells, which is Equipped with Hydraulic Stripper Assemblies and an Automatic Work-feeding Mechanism

Fig. 5. (Left) Drawing of a Typical Punch and Die Set Used in Producing the Thin-walled Steel Shells, together with the Hydraulic Stripper Assembly

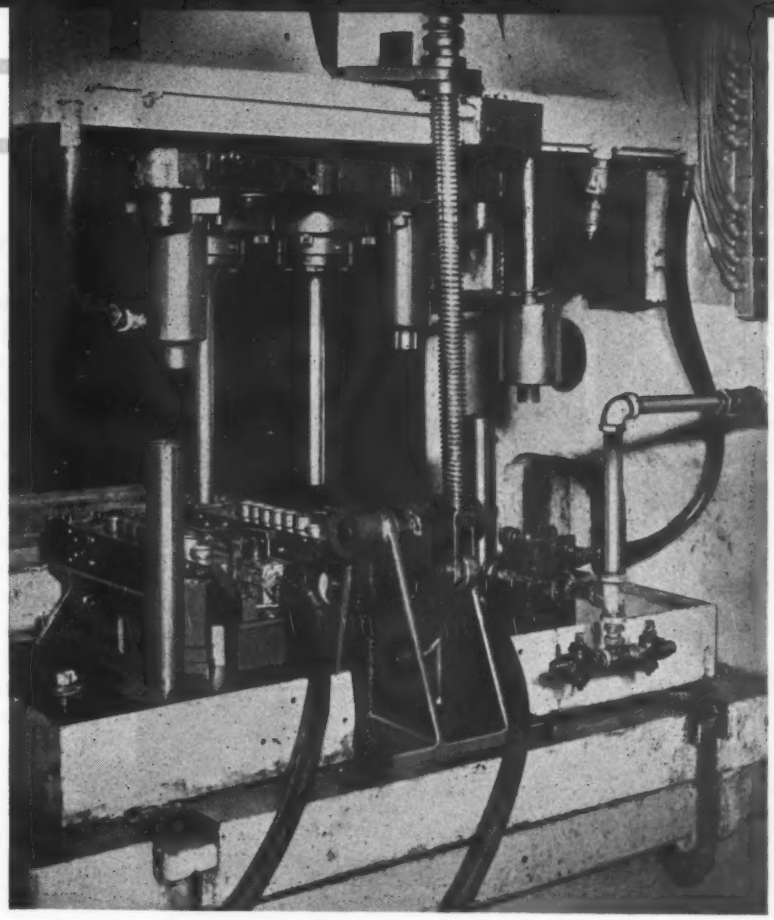


Fig. 6. Another View of the Power Press in Fig. 4, Taken from the Rear to Show the Pull-rod that Operates the Automatic Feed

let *E*, Fig. 7, and ordinarily is free to pass up a central hole *F* which extends through the upper end of the plunger or piston unit *K*. The oil leaves the orifice in the plunger directly below ball *G*. Cylinder *D* becomes filled completely with oil.

The oil also passes up through sleeves *H* and *J*, and through holes *X* in the die set to the center of the punch, as indicated in Figs. 5 and 7. A hole extends from the top of the punch to its lower end, where the oil is discharged. Sleeves *H* and *J* are perforated to permit free circulation of the oil through the sleeves and into cylinder *D*.

When the press ram starts down at the beginning of an operation, the oil is automatically shut off at inlet *E* by a valve. Then, as the punch approaches the bottom of its stroke, the lower end of the piston assembly *K* strikes a kiss-block *L* and is prevented from further descent. With a slight further descent of the press ram, ball *G* is brought into contact with the upper end *T* of plunger *K*, and a seal is thus established which prevents the oil from being forced back into the supply system.

Consequently, the lower cylinder *D* descends in relation to the piston, the greater the pressure developed in the oil line that leads to the bottom of the punch. The pressure is increasingly developed until it is sufficient to force the work-piece from the punch. Ejection of the work is so effective that the press can be operated at thirty-two strokes per minute.

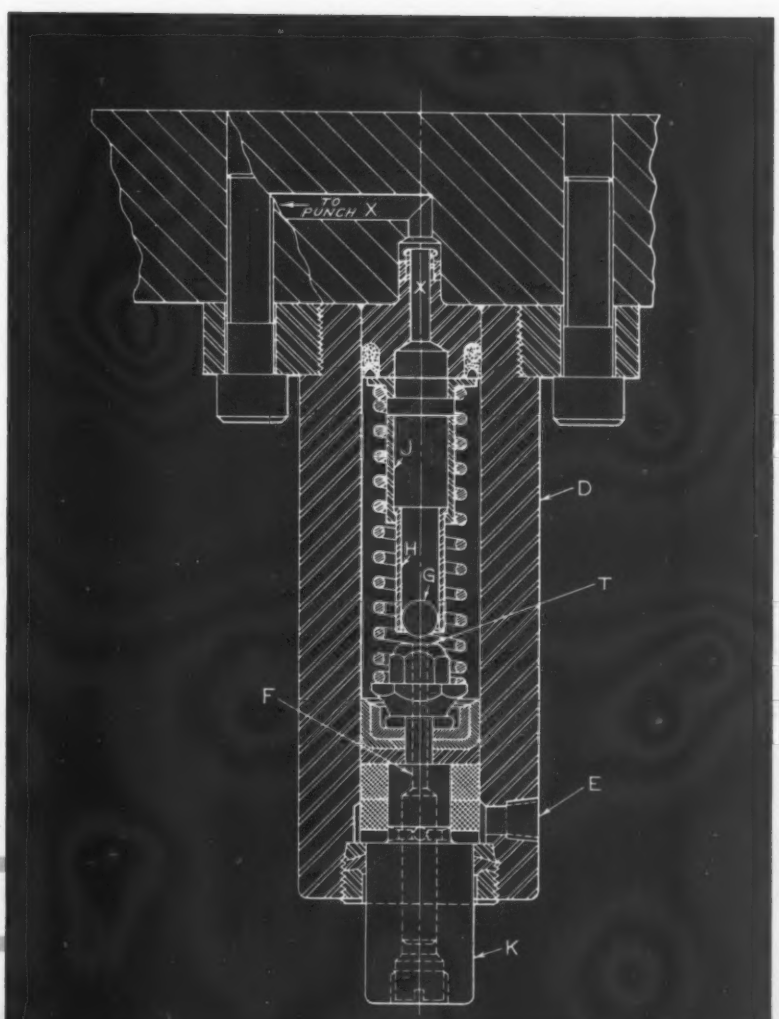


Fig. 7. Cross-sectional View of One of the Hydraulic Stripper Cylinders Provided on the Power Press Illustrated in Figs. 4 and 6

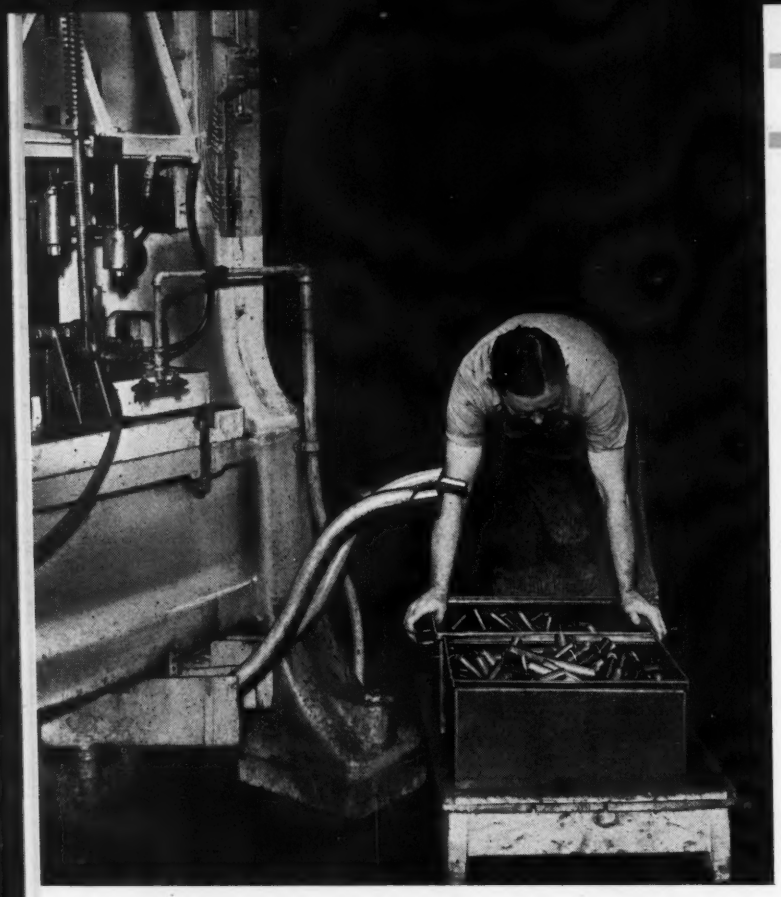
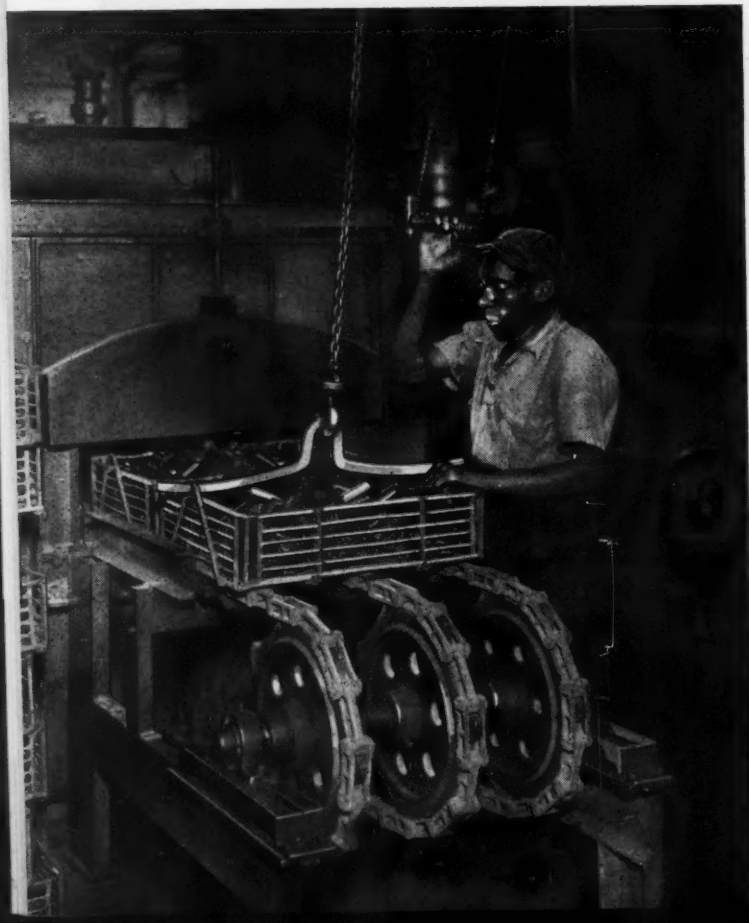


Fig. 8. After the Thin-walled Shells Drop from the Punches, They are Pushed through Curved Tubes to the Rear of the Machine for Automatic Delivery into Tote Boxes

Fig. 9. View of One of the Conveyor Type Furnaces in which the Shells are Annealed between Two of the Drawing Operations



As previously mentioned, the shell expands slightly with the increase of pressure, which facilitates its ejection; in addition, the oil serves to lubricate the inside of the shell and the punch thus aiding in the removal of the work-piece. In the event that the hydraulic arrangement failed to function for any reason, a safety trip would operate a micro-switch and stop the press as the punch started on its return stroke, thus preventing any damage to the punches and dies.

Cylinder *D* must be of rugged construction in order to withstand the high pressure developed. In fact, it became necessary to redesign the cylinder several times until it was four times as strong as what had ordinarily been considered satisfactory. Pressures as high as 10,000 pounds per square inch have been developed in the system. However, the pressure is directly dependent upon the degree with which the individual work-pieces adhere to the punch. The instant that the part slips off the punch, the pressure drops to zero. Until the ball check was provided in these hydraulic strippers to prevent back pressure into the supply line, several die sets were smashed due to the high pressures. The punches are customarily made of a high-carbon steel and chromium-plated. The oil that is discharged from the punch returns to a reservoir for use again and again, so that the oil loss is negligible.

When the shells drop from the punches, they fall into long tubes which lead down under the bed of the press and then up to a height of several feet at the back of the machine, as seen in Fig. 8. The shells fall directly from these tubes into tote boxes.

Reference has already been made to the automatic feeding arrangement with which the drawing presses were equipped, one of which is illustrated in Figs. 4 and 6. This automatic feed is operated by a pull-rod at the back of the press, which is connected at the upper end to the press ram and at the lower end to a bellcrank lever. The pull-rod is shown diagrammatically at *M*, Fig. 10, and the bellcrank lever at *N*. Through suitable linkage, the movements of the pull-rod are imparted to a horizontal draw-bar *O*, which extends to the front of the fixture. There, through bar *P*, the draw-bar is connected to two pusher-blocks *R*, one on each side of the fixture.

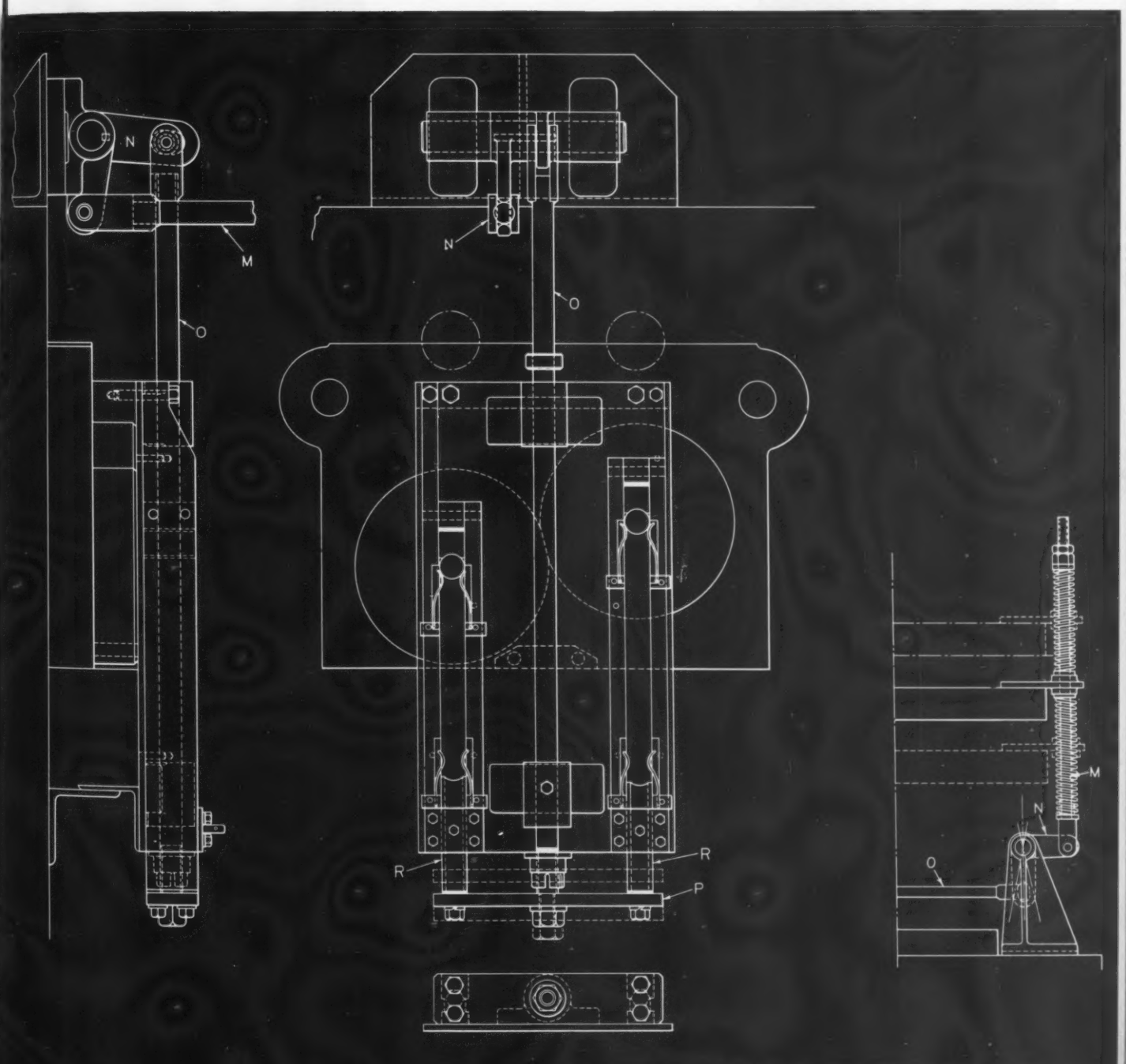
These pusher-blocks are reciprocated in channels designed to carry the shells into position beneath the punches. The shells are ad-

vanced a distance equal to the diameter of one shell with each forward movement of the pusher-blocks. When the latter return, detents provided in the channel walls prevent the shells from coming back with them. Fig. 10 shows strip springs being employed for this purpose instead of the spring-backed detents now used. With each return of the pusher-blocks, space is left to load another shell into each channel.

Flat springs of a forked construction positioned horizontally above the dies, prevent the shells from tipping over in the dies. However, in the event that a shell should be incorrectly positioned under either punch, a micro-switch would be operated to stop the machine before damage could occur. Positioning of the work beneath the punches is effected during the up strokes of the ram. The entire feed mechanism is spring-loaded right from the ram, so that if the operator should happen to have his hand caught in the mechanism, it would be impossible for him to be seriously injured.

One of the furnaces used in the annealing operations on the shells is illustrated in Fig. 9.

Fig. 10. Diagrams which Illustrate the Construction and Operation of the Automatic Feeding Mechanism Provided on the Power Presses Used for the Several Drawing Operations on the Thin-walled Steel Shells



New Officers of the National Machine Tool Builders' Association

(Left) William P. Kirk, Vice-President, Pratt & Whitney Division Niles-Bement-Pond Co., Elected President of the Machine Tool Builders' Association

(Right) Herbert H. Pease, President, New Britain-Gridley Machine Division, New Britain Machine Co., First Vice-President of the Association

Continental by RMG, Inc.

(Left) A. G. Bryant, President of the Cleereman Machine Tool Co., Who was Elected Second Vice-President of the Machine Tool Builders' Association

(Right) Richard E. LeBlond, President, The R. K. LeBlond Machine Tool Co., Recently Elected Treasurer of the Machine Tool Builders' Association

Belt Grinding—One of the Later Developments in the Grinding Field

A Review of the Applications, Methods, and Machines Used in Belt Grinding, Including Both the Platen and the Contact-Roll Type of Grinders

By W. A. PAPWORTH, Mechanical Engineer
Porter-Cable Machine Co., Syracuse, N. Y.

BELT grinding has found many new applications in recent years. Plastic bonded belts for wet grinding and improved machines for their use have combined to make it possible to obtain by this method both accuracy and speed of stock removal. The results obtained today were quite unheard of even a couple of years ago.

Belt grinding falls into two general classifications—(1) platen grinding in which the grinding is done on a straight reach of the belt supported by a platen or backing plate, and (2) contact-roll grinding, in which the grinding is done on the belt as it passes around a pulley or contact roll. The machines developed for these grinding processes do not always fall clearly within either class, but have somewhat overlapping fields.

The modern platen grinders are generally wet grinders, while the contact-roll grinders are usually designed for dry grinding; but there are some exceptions in each case. The examples of grinding equipment chosen to illustrate this article are the products of the company with which

Fig. 1. (Left) One of the Earlier Types of Belt Grinders—the "Wet or Dry" Grinder. Fig. 2. (Center) A Vertical Wet Belt Surfacer. Fig. 3 (Right) Belt Grinder with Hydraulically Controlled Ball-bearing Table

Fig. 4. Highly Magnified Chips Produced by Belt Grinding

the writer is connected, as he is more thoroughly familiar with these machines. There are, however, many other makes and types of belt grinders on the market.

Earlier Type of "Wet or Dry" Belt Grinders

One of the earlier types of "wet or dry" grinders is shown in Fig. 1. This machine was first adapted from a wood sanding machine by the addition of a water guard. More recently it has been equipped with a coolant recirculating system consisting of tank, filters, and pump. This machine uses belts of any width from 3 inches down to 1/2 inch.

It may be called a composite machine, in that it is sometimes used with a hard platen, sometimes with a padded or resilient platen, sometimes with no platen at all, and sometimes with a contact roll mounted on the table behind the belt. Usually equipped with a 3/4-H.P. motor, it has a two-speed pulley, providing for belt travels of 2500 and 3500, 3500 and 4500, or 3500 and 6000 feet per minute of belt travel.

This machine is widely used for plastic molded parts and for castings of curved or irregular contour, as well as for flat work of small area. Owing to the distance between the pulleys, platens of various forms can be used to provide concave and convex forms in the moving belt as required to fit curved or irregularly shaped pieces. Occasionally when parting flashes are to be removed from plastic parts of exceptionally irregular contour, no platen is used; instead the operator uses his fingers, protected by tape, behind the belt to twist it to follow the contour of the parting line.

Parts of circular cross-section—straight, tapered, or of irregular lengthwise contour—are sometimes ground or polished on this type of machine. The part is supported in a trough or on centers in front of the belt, and turned and moved endwise by a hand-crank or electric drill, while the belt and work are brought together by swinging either the trough or the platen, usually by means of a foot-pedal.

One user has a battery of such machines equipped with a sort of "ferris wheel" feeding device. The parts are loaded into the wheel, which revolves constantly and carries the work down past the belt. The belt is supported and made to assume a concave shape by a contact roll behind it. The parts fall out of the feeding device as they reach the bottom. Some of these special appliances can be used in connection with various types of machines.

Earlier applications of machines of the "wet or dry" type brought out clearly one characteristic—plastics and soft metals do not stick to a wet belt and load it, as they do in the case of a dry belt or solid wheel.

An important characteristic of platen type belt grinding is the possibility of grinding all over a large area at one time. This makes belt grinding particularly advantageous for grinding parts with dispersed or interrupted areas. It may or may not be advantageous to grind a solid area of some particular size and material on a belt grinder; but if that area is divided up into pads, bosses, or box-like edges, the advantage of belt grinding becomes more pronounced. In the case of small parts, several may be held in a fixture, and the same advantages are obtained as when grinding large pieces with interrupted areas. A platen type belt grinder requires no longer time for grinding a dispersed area than a concentrated area of the same number of square inches.

Application of Belt Surfacers

Fig. 2 shows what is known as a vertical wet belt surfacer. This is a nominal 8-inch size—that is, the belts used are regularly 8 inches wide, although 9-inch belts can be employed. The belt is backed up by a hardened steel platen, 9 inches wide by 12 or 16 inches high. This platen is adjustable up and down, it can be turned either end up, and can be used on both sides, so that wear is distributed over a large area before regrinding becomes necessary. This machine has regularly a 5-H.P. motor. The abrasive belt moves at speeds of 2550, 3050, 3550, 4100, or 4600 feet per minute. If necessary,

speeds as high as 5000 and 5900 feet per minute can be used.

"Tracking" and "tensioning" of the abrasive belt are provided by screw adjustments. The base has a tank with ample provision for screening, settling, and removing chips from the coolant, which is circulated by a centrifugal pump to a major spray under the table for cleaning the belt, and to a nozzle over the grinding area for cooling the work. The coolant consists of water which carries away the heat, with some additions for rust prevention. Whatever is added must not be harmful to the skin or to the work. Various soluble oils and some trade-name coolants in thin dilutions are generally used.

When the area to be ground is not too large and the material to be ground is soft and easily penetrated, hand pressure may be adequate, provided a flat surface only needs to be produced, with no great accuracy as to its location relative to other surfaces. Larger areas, more resistant materials, deeper cuts, and close tolerances call for some mechanical means for applying pressure. This may also be necessary in order to relieve the operator of excessive fatigue.

To provide a mechanical means for applying pressure, machines of this type are sometimes equipped with an oscillating table, such as shown in Fig. 5. This table has a 3 to 1 leverage for applying pressure and a micrometer stop for limiting the motion of the work relative to the belt. The operator swings the work to and fro across the belt to utilize its entire width.

The same type of machine as shown in Fig. 2, but equipped with a hydraulically controlled ball-bearing supported table, is shown in Fig. 3. This addition enables a high degree of accuracy, coupled with rapid production, to be obtained.

The work is mounted on the table in any suitable fixture or holding device. With the table at the right extremity of its travel, the operator pushes the table and work in front of the belt and oscillates it a few times on its ball bearing ways, watching an indicator that records the progress of the grinding, which continues until the zero mark of the indicator and the positive micro-stop are reached.

The table, on its first in-stroke, actuates a lever which applies pressure by means of a toggle and spring to press the work toward the belt after it has passed beyond the edge of the belt, but not before. The pressure, which is adjustable up to 450 pounds, is continuously applied without operator effort until the table returns to the loading position. At that time, it is automatically released before the work is withdrawn from the edge of the belt. The operator loads and unloads the work and rolls the table back and forth across the belt. The pressure, quick in-feed, slow in-feed during grinding, and quick retraction of the work from the belt are automatically taken care of by the table traversing motion.

A hydraulic cylinder and piston oppose the pressure of the toggle and spring and control the rate of feed by an adjustable needle valve. This arrangement provides a free and easy motion of the table, coupled with a small amount of hydraulically controlled feed, usually not over 1/16 or 1/8 inch.

In a platen grinder, it is important to have enough pressure to make the belt cut properly over the whole area being ground. This is more important than high belt speed. The operation resembles surface broaching in some respects about as much as it does grinding. Many in-

Fig. 5. An Oscillating Table Applied to a Vertical Belt Surfacer

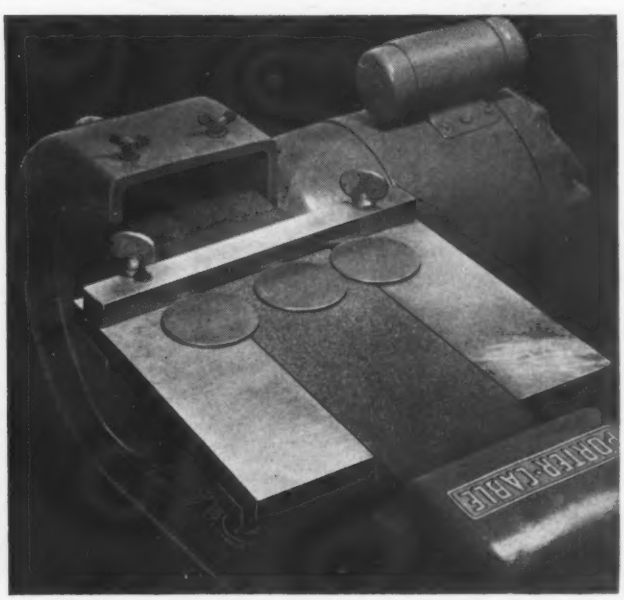


Fig. 6. An "On and Off" Table Applied to Machine Shown in Fig. 7

stances have been noted where lower belt speeds with adequate pressure have produced better results than higher belt speeds with insufficient pressure.

It is also important that an easy means of oscillation be provided, so that the wear and heat may be distributed over the entire wet-cool surface of the belt. This condition is met through the arrangement of the table and feed in this machine.

The grinding time for most operations is usually quite short—in the majority of applications only from five to thirty seconds. The depth of cut ranges from 1/16 down to 0.005 inch, or even less for finish-grinding. The tolerances obtainable are from 0.002 to 0.0005 inch, depending on the size and nature of the work. On roughing operations, stock removal rates of from 1/2 to 1 ounce per minute are not unusual.

A factor that contributes greatly to the effectiveness of belt grinding is the arrangement of the abrasive grains on the belt. They are applied to the belt in an electrostatic field, which causes them to fly upward and attach themselves endwise to the belt, so that their points rather than their sides are presented to the work. The bonding material is then applied to fill in between the grits and support them all around, leaving the points sharply protruding. This method produces a high degree of sharpness. Fig. 4 shows some of the chips produced by belt grinding, greatly magnified.

Other Types of Machines and Accessories

What is known as a "vertical-horizontal" grinder is shown in Fig. 7. This machine carries a belt 4 inches wide driven by a 3/4-H.P. motor at a speed of 3500 feet per minute. The belt is supported by a hard steel platen, 10 inches long, and the machine is adjustable for vertical or horizontal operation. This design is distinctly that of a platen grinder. A coolant system may be applied as an accessory.

Fig. 6 shows what is known as an "on and off" table, which may be used as an accessory to the machine shown in Fig. 7 when operating in the horizontal position. This table consists of hardened plates mounted on each side of the belt and so adjustable that their surface is even with the surface of the abrasive belt being used. The stop-bar shown prevents the work from being carried along by the belt. The operator slides the work from the "on" table over the belt, oscillates it a few times, and then pushes it on the "off" table. Water or other coolant is used for most plastics and metals to avoid dust, keep the work cool, and avoid loading the belt.

Fig. 7. A Platen Type Belt Grinder which is Adjustable to any Position between the Horizontal and the Vertical

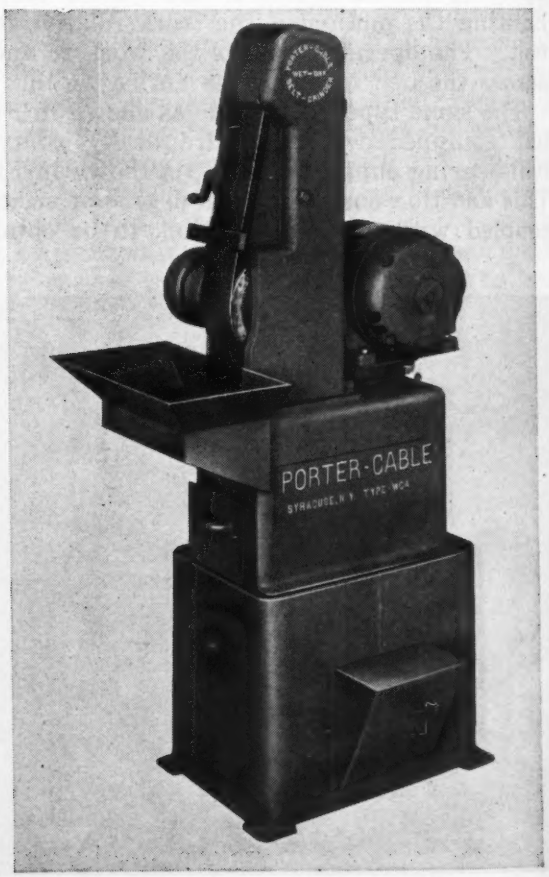
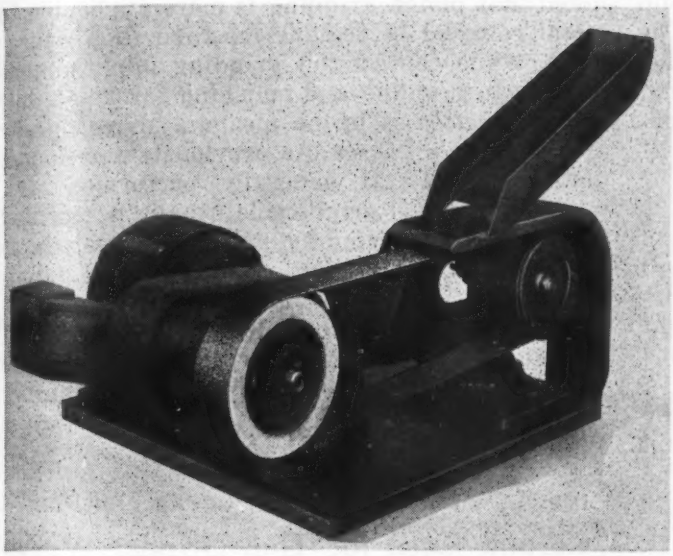


Fig. 8. A Combination Platen and Contact-roll Wet Grinder



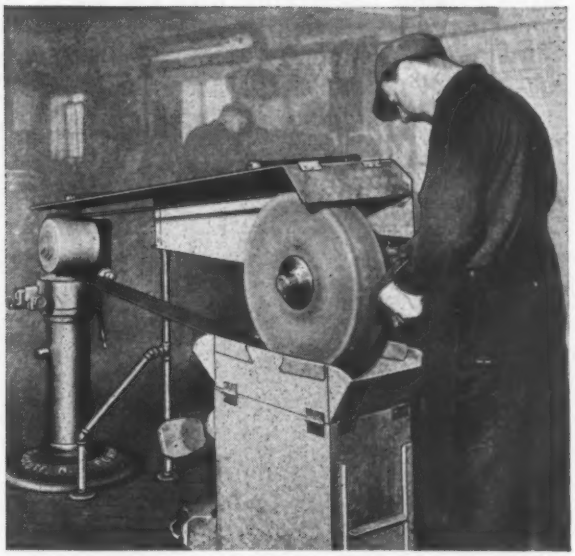


Fig. 9. (Left) The Well-known Bench Type of Contact-roll Grinder. Fig. 10. (Right) A Contact-roll Belt Grinder Made up of a Back-stand Idler and a Conventional Polishing Lathe

Fig. 8 shows a machine adapted for either platen or contact-roll grinding. In this case, the machine is permanently arranged in a nearly vertical position, with a coolant system built into the base. It uses a 4-inch belt, and a 1 1/2-H.P. motor provides a belt speed of 4600 feet per minute. A hardened steel platen, 4 by 9 inches, is mounted above the contact roll, and can be reversed end for end and side for side. An adjustable table is available as an accessory, which can be set square or at any desired angle to the belt. The catch pan, shown in front in Fig. 8, can be removed to permit special fixtures and appliances to be mounted on the machine. Small holding fixtures can be mounted without removing the pan.

Parts having a surface that must be platen ground for flatness, as well as curved surfaces that are better handled by contact-roll grinding, can be advantageously ground on this type of machine. It is especially suitable for applications where wet contact-wheel grinding, the avoidance of dust, and the keeping of the work cool are features of particular importance.

Contact-Roll Belt Grinding

In belt grinding on a contact roll, unlike platen grinding, only a small area is ground at one time. With this method, adequate pressure can be provided by hand, and on most applications of this type of grinding high belt speeds are suitable and advantageous.

With a hard roll, the area of contact is almost a line across the roll, broadened to bands of varying widths according to the softness of the roll and the pressure applied. The curvature of the roll provides immediate clearance for the hot chips, both from the work and the belt, and the rapidly moving belt is air-cooled on both sides as it travels along.

When the abrasive belt strikes the work, it is traveling at high speed around the arc of the roll, and is pressed outward not only by the roll, but by centrifugal force. Obviously, on contact with the work, there is a strong tendency to cut effectively into it. Contact-roll belt grinding, therefore, provides adequate pressure between belt and work, penetration, fast cutting, and rapid heat dissipation. Machines of this type, one of which is shown in Fig. 9, are consequently characterized by speed and cutting ability out of proportion to their size. The machine shown has a 1-H.P. motor with a belt speed of 6700 feet per minute on an 8-inch roll.

Back of the contact roll, a platen is mounted which can be adjusted so as to bear under the upper reach of the belt, to support the lower reach from above, or not to touch the belt at all. Since both the motor and the machine are mounted on a flat base, the whole unit is portable and can be moved to any convenient bench if not mounted on an individual stand. When a grinder with an extra long reach of belt is required, the idler unit may be removed from the base and installed farther back on an auxiliary support.

The applications of machines of this type are manifold, ranging from high-production manufacturing operations to such work as chamfering and deburring.

Back-Stand Idlers Convert Polishing Stands into Belt Grinders

Fig. 10 shows a backstand idler used as an adjunct to the conventional polishing lathe which converts it into a belt grinder when de-

sired without interfering with the use of set-up polishing wheels when these are preferred. The contact roll is mounted on the polishing lathe, and the idler unit on the floor, wall, or ceiling, in accurate alignment back of it. The arrangement in Fig. 10 shows a floor mounting, while Fig. 11 shows a wall mounting, which may be equally well applied as a ceiling mounting.

Both these units have a dual tracking arrangement. The head of the idler unit can be turned and locked so that the idler shaft is exactly parallel to the contact-roll shaft. This adjustment is generally not altered when belts and wheels are changed.

The other adjustment shifts the idler pulley axially so that its crown is always "running fair" in the center of the belt and in the plane of the belt. This adjustment takes care of belts of different widths without resorting to angular misalignment for tracking, which would cause uneven wear on the crown of the idler pulley and ultimately uneven running.

In the machines illustrated, belt tension is applied by means of a weight, which is placed on a lever arm to provide more or less tension as desired. An oil cylinder and plunger prevent too rapid movement of the weight and idler, both when the machine is in normal operation and in case of belt breakage. Owing to the inertia of the weight and the damping effect of the oil cylinder, the belt runs so smoothly that its appearance to the eye is about the same when it runs at 10,000 feet per minute as when it is standing still.

From the foregoing discussion of the applications of different types of machines, it will be noted that platen grinding is more applicable to metal removal in regular machine shop operations, while contact-roll grinding applies more directly to grinding and polishing for finish, but this distinction is by no means a sharp one or applicable in all cases. As previously mentioned, platen grinding is generally performed wet, while contact-roll grinding is usually performed dry. In platen grinding, adequate pressure is the primary requirement. In contact-roll grinding belt speed is more important.

On operations to which it is well suited, belt grinding has often given surprisingly favorable results, and production engineers are becoming more and more interested in its possibilities.

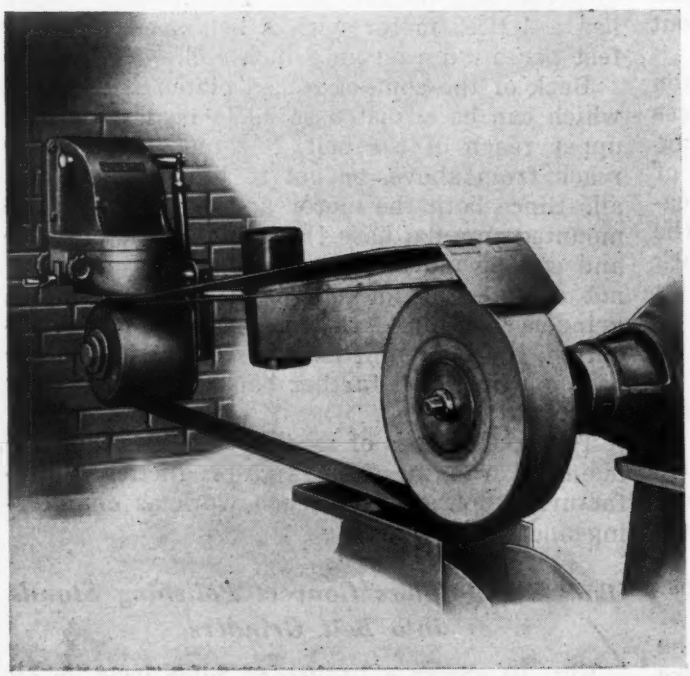


Fig. 11. Equipment Similar to that Shown in Fig. 10, but with the Back-stand Idler Attached to a Wall

* * *

Carbide Used for Tool Grinder Ways

Bearing surfaces of tungsten carbide, sliding against tungsten carbide, have materially reduced maintenance costs and "down time" on a grinding machine used at the plant of the Carboloy Company, Inc., Detroit, Mich. Carbide dovetail ways and wear strips have been used to replace the cast-iron ways and gibs originally provided on this machine. The Carboloy ways which are now used on this machine consist of two upright dovetails, each about 9 3/4 inches long by 1 inch by 1/2 inch. Bearing directly against these dovetails are two Carboloy inserts 8 1/2 by 1 by 3/16 inch on one side of the head, in addition to a tapered carbide gib on the other. Thus all the bearing surfaces are made from solid cemented carbide. The grinding machine so equipped has been in continuous use for more than seven months with two eight-hour shifts per day, and no signs of wear have been detected.

* * *

Material Handling Society Formed

A group of men interested in material handling, at a recent dinner meeting in the Roosevelt Hotel in Pittsburgh, organized a new society, to be known as the Material Handling Society. The objectives of the Society are to further the application of good material-handling practices; to encourage an interchange of ideas among the members; to promote education and training in the science and practice of coordinated material handling; and to arrange for the collection and dissemination of information relating to all phases of material handling. Further information can be obtained from Richard Rimbach, temporary secretary, 1117 Wolfendale St., Pittsburgh 12, Pa.

Recent Applications of the Thread-Rolling Process

Precision Threading, Knurling, Serrating, and Burnishing Operations are being Performed at High Production Rates on a New Thread-Rolling Machine Having Several Novel Features

Fig. 1. Triple-roll Hydraulically Operated Thread-rolling Machine Developed Recently for Use in the Production of Parts such as Shown in Fig. 2

THE threading, knurling, serrating, and burnishing of small solid and hollow parts, such as shown in Fig. 2, to meet the exacting requirements of the aircraft, automotive, and accessory industries are being accomplished successfully as a result of new design features incorporated in the thread-rolling machine illustrated in Fig. 1. In developing this machine, the National Acme Co., Cleveland, Ohio, has made provision for replacing the hand loading equipment shown in the illustration with a hopper or magazine to obtain continuous automatic operation.

In order to obtain rolled threads of Class 3 or closer fits on solid as well as thin-shelled hollow pieces, a triple-roll hydraulically operated head of a radically new design was developed. In this head, three rolls like those shown in Fig. 3 are arranged as illustrated diagrammatically in Fig. 4. Two of these standard

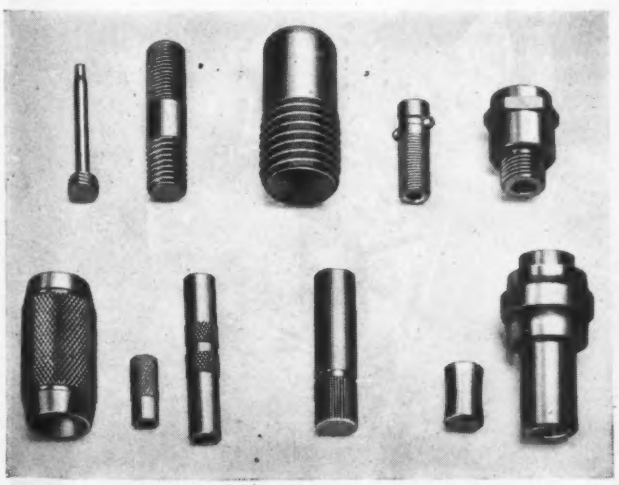


Fig. 2. Examples of Small Solid and Hollow Parts on which Precision Threading, Knurling, Serrating, and Burnishing Operations have been Performed

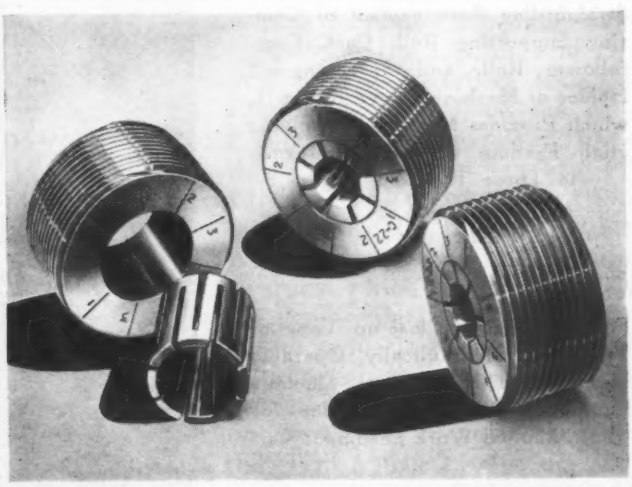
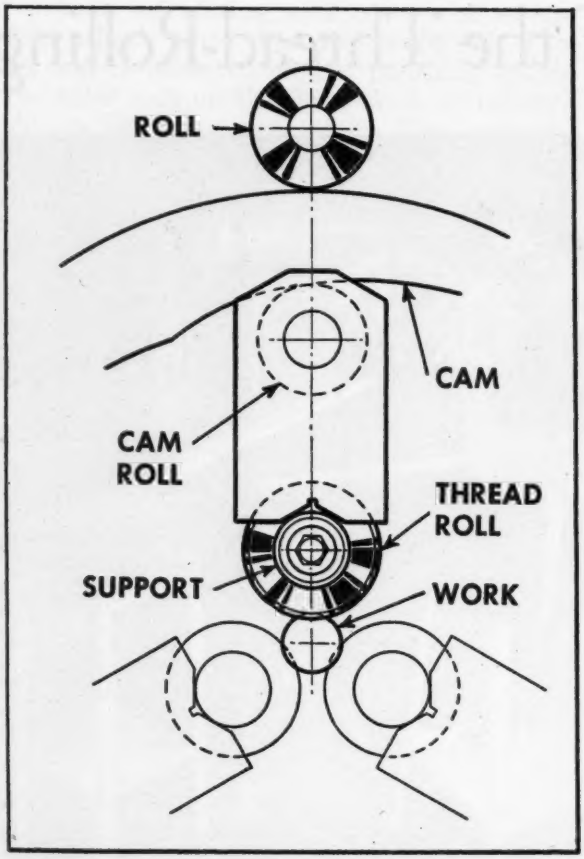


Fig. 3. Threading Rolls and Expanding Bushings by Means of which the Rolls can be Securely Mounted on the Spindles of the Thread-rolling Machine



heads, like the one shown in Fig. 6, which can be interchanged in twenty minutes, have a capacity range for rolling threads from 3/8 to 1 inch in diameter and up to 1 1/2 inches in length. The exceptionally smooth finish and improved tensile strength of the threads produced with this equipment are characteristics that were given careful consideration in developing the powerful, uniform roll driving and feeding mechanisms.

When the machine is operated manually, the piece to be threaded is pushed into position between the three rolls *C*, Fig. 5, by the plunger *A* until it is positioned by the work-stop. Pressure on the foot-pedal switch then starts the working cycle, in which the rotating rolls *C* are forced radially inward until they penetrate the work to the required depth. The rolls then return to the open position and the stop ejects the threaded piece, which slides down a chute into the work box. For continuous automatic operation with a magazine loader, accurate cycle control is obtained by means of an electric timer located in the control box.

The heart of the rolling machine is the interchangeable operating head shown removed from the machine and minus the threading rolls in Fig. 6. The threading rolls (Fig. 3) are mounted on the spindles of the head, as illustrated at *C* in Fig. 5. The threading rolls are securely held on their respective spindles by expanding type bushings, one of which is shown removed from the roller in Fig. 3. It will be noted that no driving keys are employed, a feature that permits fine adjustment of the threading rolls to any desired positions on their spindles. Correct location of the starting portions of the thread for perfect synchronization of the three threading rolls is quickly obtained by setting the graduations or markings on the front faces of the threading rolls in 1-2-3 order with respect to the axis of the work.

Fig. 4. (Above) Diagram Showing Straight-line Arrangement of Cam-ring Supporting Roll, Cam, Cam-follower Roll, and Threading-roll Holder of Machine Shown in Fig. 1, which Provides Means for Applying High Feeding Pressure Uniformly to Three Threading Rolls

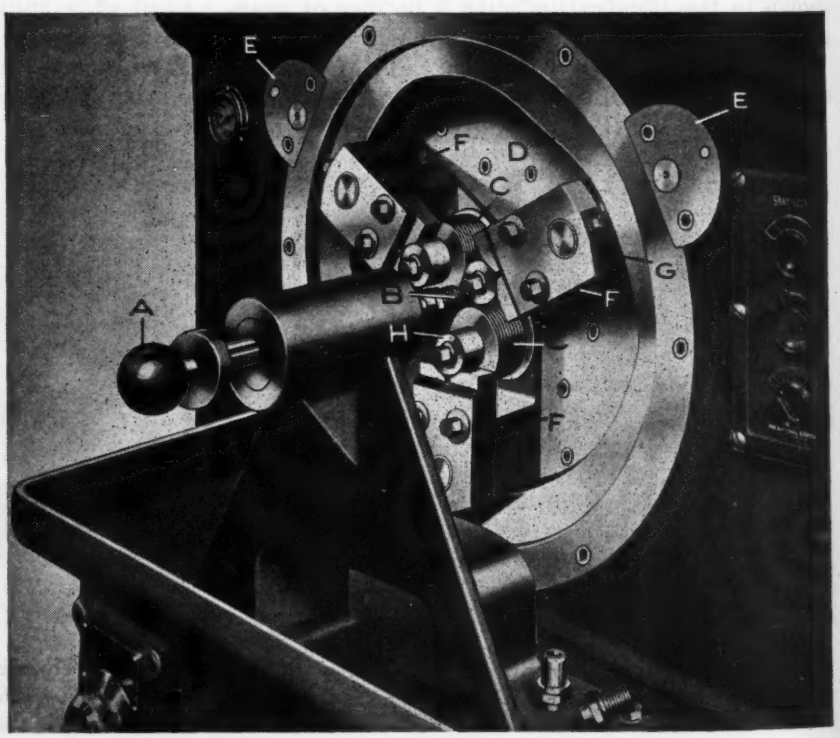


Fig. 5. (Right) Close-up View of Triple-roll Hydraulically Operated Head of Thread-rolling Machine Equipped with Hand Loader for Manual Work Feeding

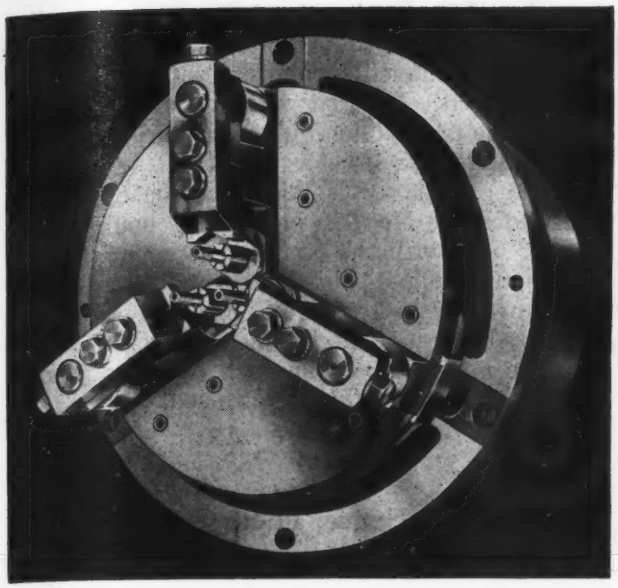


Fig. 6. Interchangeable Head Unit of Thread-rolling Machine with Threading Rolls Removed. Heads like This One with Rolls Set for Different Sizes of Parts can be Quickly Interchanged

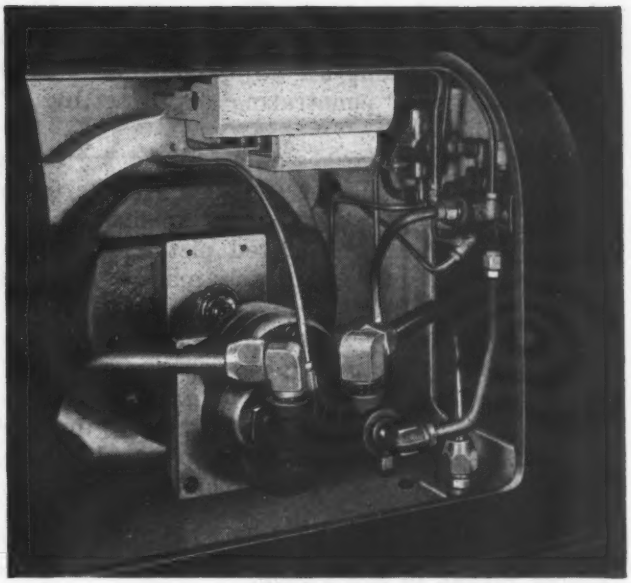


Fig. 7. Fluid Motor Located inside the Upper Frame of Thread-rolling Machine at Rear of Head Shown in Fig. 1. This Motor Drives Each of the Three Threading Roll Spindles Independently through a Central Gear

The spindles that carry the threading rolls are independently driven through one center gear by the fluid motor shown in Fig. 7, which is located at the rear of the operating head inside the upper frame of the machine and above the oil reservoir. The spindle speeds are selective, and are changed to suit the work by means of a dial on the front of the machine base.

The spindles on which the rolls *C*, Fig. 5, are mounted are, in turn, mounted in the radially positioned holders *F* on the face of the operating head. The outer ends of the roll spindles are fitted with anti-friction roller bearings *H*. The outer races of these bearings, which receive the pressure from the guide holders *F*, do not rotate; the inner races are secured by studs to the spindles.

The guide holders *F* are mounted on the head in radially positioned, accurately fitted slide ways to permit the threading rolls to be fed into the work. The radial inward feed is transmitted to the rolls *C* from the heavy cam ring *D* through follower rolls *G* on the outer ends of holders *F*. The rolls *G* are also shown in Fig. 6. These rolls are kept in contact with their respective cam surfaces on ring *D* by spring plungers.

Referring to the diagram, Fig. 4, it will be clear that clockwise rotation of the cam will cause the follower roll, roll-guide holder, and the threading rolls to move inward as a unit, forcing the revolving threading rolls into the work. When the threading rolls have been fed in to the required depth, movement of the cam ring is reversed. The roll-guide holders and the threading rolls are then moved outward to their starting positions by the spring-actuated plungers which keep the follower rolls *G*, Fig. 5, in contact with the cam ring.

The heavy cam ring *D*, the periphery of which is concealed by the frame housing, is supported in the latter member by three anti-friction bearing rollers mounted under bearing caps *E*. In the diagram, Fig. 4, one of these cam-ring supporting rollers is shown at the top of the view in contact with the periphery or outer face of the ring. The straight-line support received by the threading rolls directly from the rigid frame through anti-friction bearing rolls and positive camming, as indicated in the diagram, insures the application of a uniform powerful feeding pressure to each threading roll.

The mechanism that oscillates the cam ring *D*, Fig. 5, for transmitting the feeding and retracting movements to the threading rolls is notable for its simplicity, as well as the efficiency with which it performs its required functions. The segment of the outer surface or periphery of the cam ring *D* located between the supporting rollers concealed by the two upper cover plates *E* has accurately machined teeth which mesh with a worm which serves as a rack for transmission of the oscillating movement to ring *D*, and also as an adjusting screw for controlling the depth to which the threading rolls are fed into the work. The worm-shaft in its horizontal position at the top of the cam ring extends both to the right and left. Its left end terminates in a piston within a hydraulic cylinder which imparts the required oscillating movement to the cam ring through the rack and pinion action described. At the right-hand end

of the worm-shaft is fitted a positive locking micrometer handwheel with 1/8-inch graduations that represent an adjustment of 0.0005 inch in the work penetrating depth setting of the threading rolls.

When the worm serves as a rack, it performs the function of oscillating the cam ring through the reciprocating movement imparted to it by the hydraulically operated piston, in which case the coarse-pitch accurately machined worm threads serve as rack teeth. When used for adjustment of the thread rolling depth, the worm serves as an adjusting screw for the cam ring travel without imparting any longitudinal movement to the worm. Thus, without changing the length of the piston stroke, the position of the cam ring with respect to that of the worm can be adjusted to control the depth to which the rolls are fed into the work at the end of the feeding stroke of the piston.

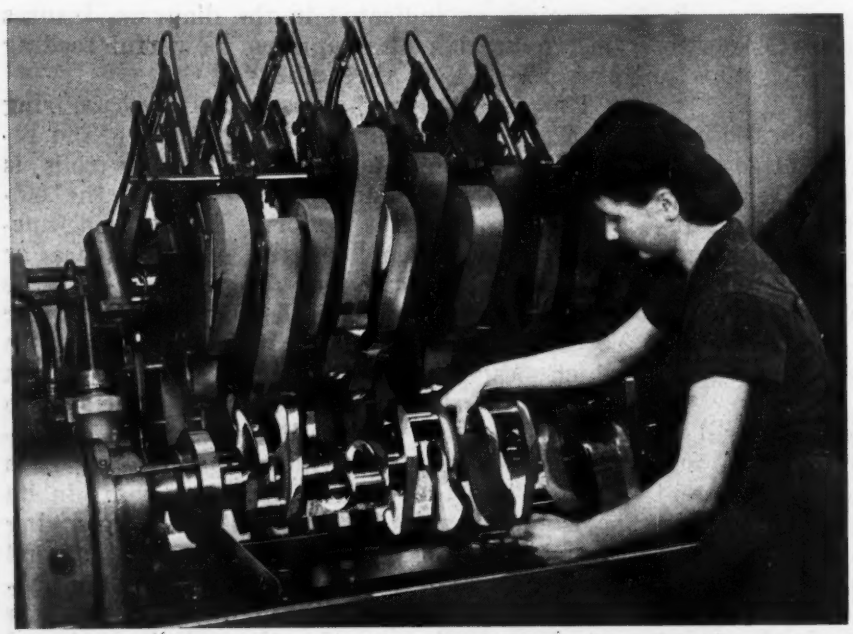
The length of the piston stroke is controlled by a positive, adjustable stop, its reversal being accomplished by a limit switch and solenoid-operated valve. The hydraulic pressure which forces the roller to penetrate the work is regulated by a hydraulic valve at the left on the lower frame of the machine, and is indicated by the gage at the side of the operating head.

* * *

Surface Finish of Crankshaft Bearings Improved at Cadillac

The Cadillac Motor Car Division of General Motors used to polish aircraft-engine crankshaft pins and bearings on two lapping machines. The first operation was performed with No. 320 grit abrasive cloth to size the journals and to eliminate taper and out-of-roundness. Then the shafts were moved to another lapping machine equipped with 400-grit waterproof-back paper.

Now the final polishing operation is completed on the same machine as the first. A strip of No. 400 grit paper is laid over the crankshaft and under the No. 320 belt. This double thickness of belt, with the No. 400 paper against the shaft journals, polishes to a profilometer reading of from 1 1/2 to 1 3/4 millionths of an inch, as compared to surface finishes of between four and five millionths of an inch obtained when a second lapping machine was used.



Polishing Aircraft-engine Crankshaft Pins at Cadillac Plant

* * *

A Common-Sense Theory of Taxation

Alfred P. Sloan, Jr., chairman of General Motors Corporation, pointed out, in an address, that taxes should be based upon the same philosophy that we employ in our mass production industries. According to that philosophy, the lower the price of the products of industry, the greater the sales and the greater the revenue resulting; correspondingly, the lower the rates of taxation, the greater is the stimulus to business and the more is the tax base expanded, so that total revenues can be greater with a lower tax rate than with a higher.

Said Mr. Sloan: "American business men, especially in the industries, down through the years have distinguished themselves for their ability to produce goods and services of endless variety and of astonishing quality at steadily lower prices. The time has now arrived when American business men must assume the role of economic statesmanship. They no longer must be satisfied with the mere phase of production of goods and the rendering of services. They must recognize their responsibility to the national economy as a whole."

* * *

Air Transport Meeting of Automotive Engineers

A National Air Transport Engineering meeting is to be held under the auspices of the Society of Automotive Engineers, December 3 to 5, at the Edgewater Beach Hotel, Chicago, Ill. Numerous papers relating to air transport engineering will be read at the seven technical sessions scheduled.

Use of Solvents in Cleaning Machinery for Reconversion

Much Machinery was Stored during the War Period. Now Protective Oils and Greases Must be Removed. This Article Deals with the Safe Use of Solvents for This Purpose

By MABLE FOY, Ph.D., Industrial Hygienist
Safety Research Institute, Inc., New York City

ONE of the first steps in reconversion is the removal of protective materials, such as oils, greases, or paints, used to prevent rusting and corrosion of machinery and tools when not in use during the war period. Organic solvents are invaluable in this work, but the dangers in their use must be recognized and adequately controlled in order to insure safety. All organic solvents, if improperly used, may endanger health, and some present a fire hazard.

Methods Used in Cleaning Machinery that has been Stored Away

It will probably be found that over-generous and hasty work in applying protective materials has resulted in thick layers or heavy lumps of grease on some parts of the machines. These deposits should be removed with putty knives, rubber spatulas, and dry rags or waste before cleaning with solvent. Obviously, the accumulations of grease, together with oily rags and waste which are to be discarded, constitute a fire hazard, and should be collected immediately in covered metal waste cans and discarded with suitable precautions at the end of each working day. As rust-retarding grease is likely to be harmful to the skin, the hands and arms should be protected from it. Work clothes should be kept as clean as possible.

Once the major part of the grease has been removed, the machine can be washed thoroughly clean with a suitable solvent. In hand cleaning, the surfaces are usually scrubbed with rags or brushes wet with solvent, or the liquid may be squirted over the dirty part of the machine and the machine wiped. Most organic solvents evaporate quickly at ordinary temperatures, so that it is not necessary to wipe the machine dry. Blowers should never be used to speed the drying, as this hastens the evaporation and mixes dangerous vapors with the air in the room.

Small tools and machine parts can best be cleaned in a regular degreaser, with which many plants are equipped. Degreasing equipment making use of hot solvent should not be improvised without advice from an engineer experienced in this field, who is familiar with the details of the problem in hand.

Polished metal surfaces that are completely free of oil are highly susceptible to rapid corrosion, particularly in a damp atmosphere. To avoid this, it is advisable to add from 2 to 5 per cent of light machine oil to the solvent.

The oily solvent that remains after a cleaning operation constitutes, in itself, a danger if discarded improperly. The practice of pouring solvents down a sink is exceedingly hazardous in the case of flammable solvents, and is undesirable in the case of any solvent.

Dangers to be Guarded against in Working with Cleaning Solvents

The two characteristics of organic solvents that make them effective in cleaning grease and oil from machinery—the ease with which they evaporate into the air and their ability to dissolve grease—are precisely those that make them potentially dangerous to health. Liquid solvents, if they come in frequent contact with the skin, cause a red, rough condition, which may be followed by infections. Solvents in which heavy oils and greases are dissolved may have a much more serious effect on the skin.

Inhalation of solvent vapors may cause headache, digestive disturbances, and even unconsciousness. In extreme cases, fatal results have been recorded. Prolonged or repeated inhalation of air containing excessive amounts of solvent vapors are decidedly dangerous to the health. Small amounts of solvent vapor in the air are, however, safe for most people, although the amount that may be inhaled without danger varies with the solvent. It should be stated here that none of the ordinarily used cleaning materials are so hazardous that protection from their vapors cannot be insured through the proper

use of standard types of ventilating devices; on the other hand, none of them are safely used without proper ventilation.

Fire and Explosion Dangers

Among flammable solvents, those with low flash points present the greatest fire hazard. When such vapors are mixed with air in small amounts, they form explosive mixtures that can be set off by a spark, cigarette, or broken light bulb. More concentrated vapors burn violently. The flammable solvents with higher flash points evaporate more slowly, and are not likely to form explosive mixtures with air, although the liquids burn vigorously.

The vapors of flammable solvents are heavy and have a tendency to form an invisible moving stream near the floor, which may flow into nearby rooms and down stairs and shafts. If the vapor comes in contact with a flame or spark, there is an explosion, with a flashback along the vapor stream and an explosion and fire at its origin. The comparative fire hazards of flammable solvents have been established and recorded by the Underwriters' Laboratories. Sometimes the flammability rating of a solvent is lowered appreciably through admixture with a non-flammable liquid, such as carbon tetrachloride. It is advisable to check such mixtures carefully just before use, in order to make sure that their composition has not changed.

Ethyl gasoline, which is not only flammable, but also contains an extremely poisonous chemical—lead tetra-ethyl—should never be used in any cleaning or degreasing operation.

Certain solvent mixtures and paint removers are marketed by trade names. The necessarily brief warnings printed on the labels of these preparations are not always adequate guides to the precautions required in their use. To avoid accidents, it is essential to know the chemical nature of the solvent employed.

Specific Precautions in the Use of Cleaning Solvents

Some persons are more susceptible to the effects of solvents than others. It is wise, therefore, to have a medical examination of workmen who are to clean machinery with solvents, especially if the job is a long one or if a large quantity of solvent is to be used. Because of the different effect of different chemicals, the doctor should be informed which solvent is to be used. Workmen who are to handle solvents should be told how to use them safely, and should be warned of the dangers attendant upon their careless handling. The work procedure established with an eye to safety should be carefully explained, and no deviations from the established procedure should be permitted.

The most satisfactory way of protecting the skin from the effect of solvents is by the use of gloves, and, if necessary, protective sleeves as well. These should be made from a synthetic resin or cloth coated with synthetic resin impervious to organic solvents. Rubber is usually not suitable. If gloves are not practicable, glycerine or a non-oily ointment of water-soluble gums and waxes may be rubbed into the hands. An important factor in protecting the skin from the action of solvents is a thorough washing with mild soap and water at the end of the working day.

Ample Ventilation Systems are Necessary

Even more important than the protection of the skin is the provision of means for preventing the inhalation of excessive amounts of solvent vapors. If the machinery is to be cleaned in a room in which there is a good ventilating system, this may, under certain conditions, be sufficient to carry away the solvent vapors and render the atmosphere safe. The advice of a ventilating engineer should be obtained on this matter. The precautions that must be observed are as follows:

1. If a flammable solvent is used, the ventilating system must be one adapted to handling flammable vapors; otherwise there is danger of an explosion being caused by a spark from a fan motor, for example.

2. A ventilating system that is designed simply for comfort in a work-room may not have the greater capacity necessary to dilute solvent vapors to a safe level.

3. Most solvent vapors are appreciably heavier than air and tend to sink and become concentrated at the floor level. A ventilating system that has its exhaust outlet near the ceiling may prove ineffective in controlling solvent vapors.

A second ventilation method is the use of exhaust hoods, paint spray rooms, or other areas where there is very effective ventilation. Machines or parts that can be moved can be cleaned in such places.

While it is possible in some instances to utilize existing ventilating systems, in many cases the worker has to be safeguarded by employing portable ventilating units. These ventilators should not be employed to blow air into the room or work area, since this increases the hazard by dispersing the solvent vapor into the general atmosphere. They should be used as vacuum units drawing out and expelling the vapor-contaminated air. In a small room where many portable exhausters are operating simultaneously, it is important to see that windows are open, so that plenty of fresh air can enter.

It is often possible to attach two intake tubes to one exhauster so that air may be withdrawn simultaneously from the working level and from

a point near the floor as well, thus catching the heavy vapors. By employing a number of outlets, more powerful semi-portable units can be adapted to serve several cleaning operations simultaneously. However, they should not be overloaded. If flammable liquids are used, it is essential to use a portable blower designed to handle explosive vapors safely.

Careful consideration must be given to the placing of the open exhaust end of the outlet tube. If the vapors are carried out through an open window, make sure that they will not enter the plant again through another window or through the intake of another ventilating system.

If there are no facilities for assured adequate mechanical ventilation, and if natural ventilation cannot be depended upon, those who use solvents for cleaning machinery should be protected by respirators; but in that case, the work must not be carried on in a room where there are other, unprotected people present.

The safety of the atmosphere can sometimes be gaged by the odor of solvent vapors; but with many solvents, a vapor concentration even below that which is perceptible by odor may be unsafe, so that odor alone is not a reliable gage. The only completely dependable method of measuring concentration of solvent vapors is by air analysis, which can be carried out by a competent chemist or by the state or local Health Department. If flammable solvents are used, additional precautions must be taken and special attention given to the presence of spark-producing electrical equipment in areas near the work. Fire extinguishers should also be readily available.

Summary of Safety Rules for Cleaning Machinery

1. Know your solvent and recognize its hazards from standpoints of both health and fire.
2. Define the job procedure and keep close watch on the job environment. Remember that waste materials can be dangerous.
3. With all solvents guard health as follows:
   (a) Choose workmen who are not especially susceptible to solvent poisoning.
   (b) Use gloves or protective creams to guard the skin.
   (c) Protect against the inhalation of solvent vapors, by ventilation or respirators, and check by air analyses.
   (d) Look out for symptoms of poisoning, and have a second medical check-up when the work is done.
4. With flammable solvents, guard against fires and explosions, as well as injury to health:
   (a) Make sure the ventilating system is safe to use with flammable vapors.
   (b) Keep fire extinguishing equipment near the work.
   (c) Observe standard precautions for the handling of flammable liquids.

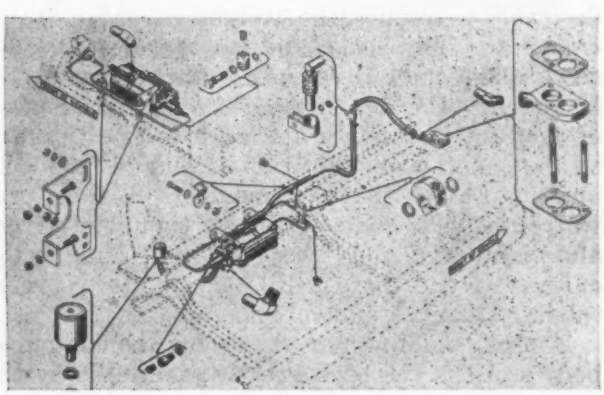
* * *

National Patent Council

Plans for a counter-offensive against attacks on the United States patent system are being made by a nation-wide group of smaller manufacturers representing twenty-eight classes of industries, according to an announcement by John W. Anderson, president of the Anderson Co., Gary, Ind., leader of the movement. The new organization, incorporated as the National Patent Council, will have headquarters at Gary, Ind., and will maintain offices also in New York and on the Pacific Coast.

"Although the critics of the patent system profess to be saving the country from monopoly," said Mr. Anderson, "they are in reality promoting monopoly by threatening the life of every smaller company relying on patents.... So long as Congress and the courts maintain the traditional seventeen-year exclusive right of the inventor to his own creation, the smaller manufacturer can continue to introduce successfully products of greater value to the public in the markets of competitors."

A pictorial technique developed by the Bendix Aviation Corporation, known as the "Installograph," suggests many uses in the mechanical industries. Similar treatment could be employed to advantage in many instances in the machinery field. The drawing here reproduced shows in heavy lines the component parts of the Bendix "Hydrovac" braking system. The dotted lines show in perspective the installation as applied to a typical chassis



Aircraft Manufacturing Technique

AN analogy can be drawn between the manufacture of airplanes and the building of motor buses. In the first case, it is essential to keep down the weight in order to promote flying efficiency, while in the second case, it is desirable to reduce the weight in order to increase the pay load and cut down operating costs. The Brill Division of the American Car & Foundry Co. has effected a weight reduction of over 1000 pounds in its latest inter-city buses by the generous substitution of aluminum sheets and shapes for the steel members used in prewar buses. The bodies are built completely from aluminum and the frame is also constructed entirely from that metal, except for several tubular steel cross-members.

The use of aluminum sheets for the contoured body sections has been greatly facilitated by the adoption of manufacturing methods originally developed in the aircraft industry. The technique involves the use of Kirksite dies on pneumatic hammers, and forms of the same material on stretch presses. Prior to the war, many of the contoured pieces were formed by hand at considerably higher cost.

Another advantage derived from the use of Kirksite is a far more artistic bus design, because of the fact that more complicated contours can be developed in the sheets that make up the front, back, and interior of bus bodies than were possible with the previous manufacturing methods. Some of the Kirksite forms weigh as much as 50 tons.

Over 200 different aluminum parts are produced by this technique for one type of bus, and 175 additional parts for another type of bus

Applied to Bus Building

Kirksite Dies and Stretch Blocks are Now Being Employed by the Brill Division of the American Car & Foundry Co. for Forming Contoured Bus Body Sections

By R. B. STUBBS, Manager
Kirksite Die Division

which also uses a considerable number of parts identical to those made for the first type. A self-contained aluminum sheet production department has been established in a separate building. Here the plaster molds are built up, the Kirksite and lead dies and forms are cast and finished, and the drawing and stretching operations are performed. In other words, all work pertaining to the manufacture of contoured parts from aluminum is concentrated in one building. The methods followed will be outlined in this article.

The production of plaster molds for casting Kirksite dies and forms required for the front of one bus has been facilitated by the construction of the mock-up seen in Fig. 1. This mock-up is made of plaster applied to a steel frame. First sectional templets for this portion of the bus were made with a shrinkage allowance of 1/10 inch per foot. These templets were then erected on the steel frame and filled in with plaster. A rough coating of plaster was followed by a finish coat which gave nice smooth fillets and other rounded surfaces.

The construction of mock-ups like these enables production men to foresee manufacturing difficulties that are likely to arise in carrying out a new design. By discussing these difficulties with representatives of the sales department, who are, of course, interested mainly in the appearance and quality of the finished product, compromises can generally be arrived at that will reduce manufacturing problems without sacrifice of appearance.

In many cases, plaster casts can be produced directly from the mock-up for use in making plaster patterns for Kirksite dies. In other instances, measurements are taken from the mock-up and transferred to templets, which are cut out and set up as a backing for the plaster pat-

Fig. 1. Mock-up Constructed for the Front End of a Bus Body, together with a Plaster Cast Made from the Mock-up. Part of a Plaster Pattern is Seen at the Left

Fig. 2. (Above) Building up a Pattern from a Plaster Cast by Use of Plaster and Sisal. Steel Pipes Provide Reinforcement

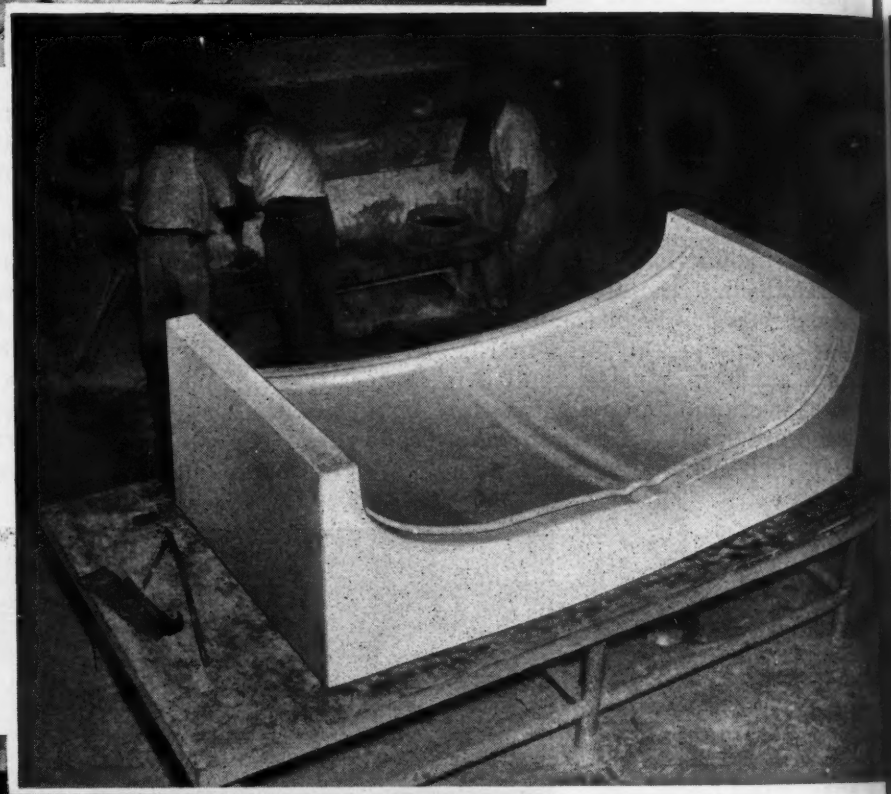


Fig. 3. (Right) A Finished Plaster Pattern for a Roof Headlining Panel after the Sides of the Molding Box have been Removed

Fig. 4. (Below) The Plaster Patterns are Withdrawn from Sand Molds by the Use of Draw-bars Equipped with Turnbuckles

Fig. 5. (Above) Sand Mold after the Plaster Pattern has been Removed and Pouring of the Molten Kirksite has Started

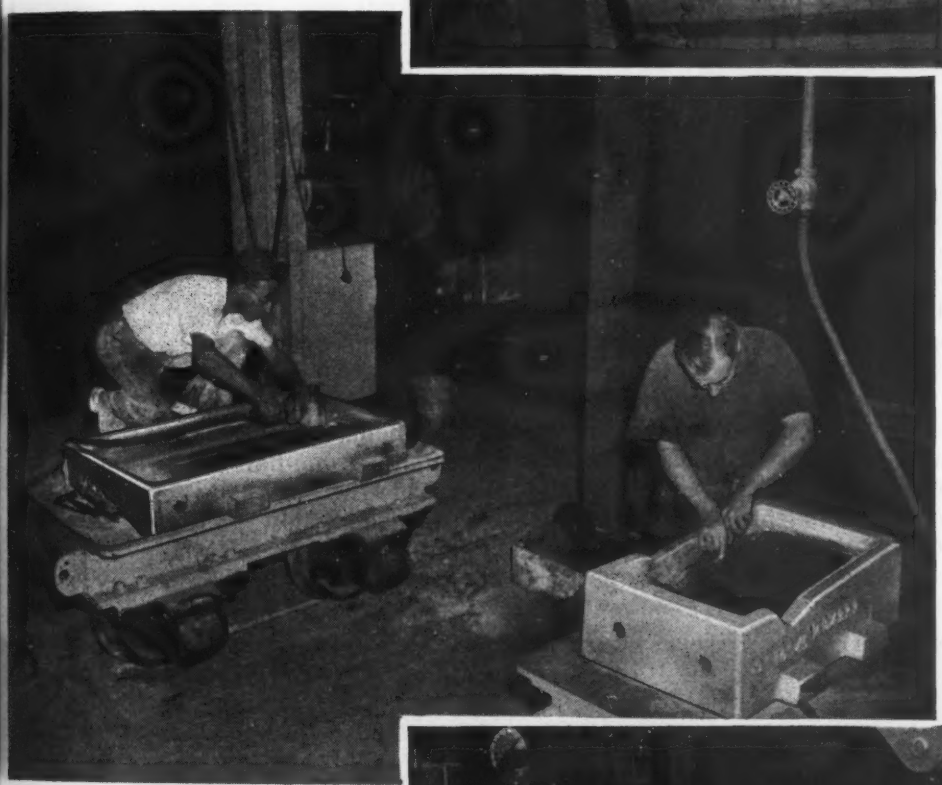


Fig. 6. (Left) The Working Surfaces of the Kirksite Dies are Smoothed down by the Use of Portable Grinders

Fig. 7. (Below) Pouring the Corresponding Punch for a Kirksite Die from Either Lead or Kirksite

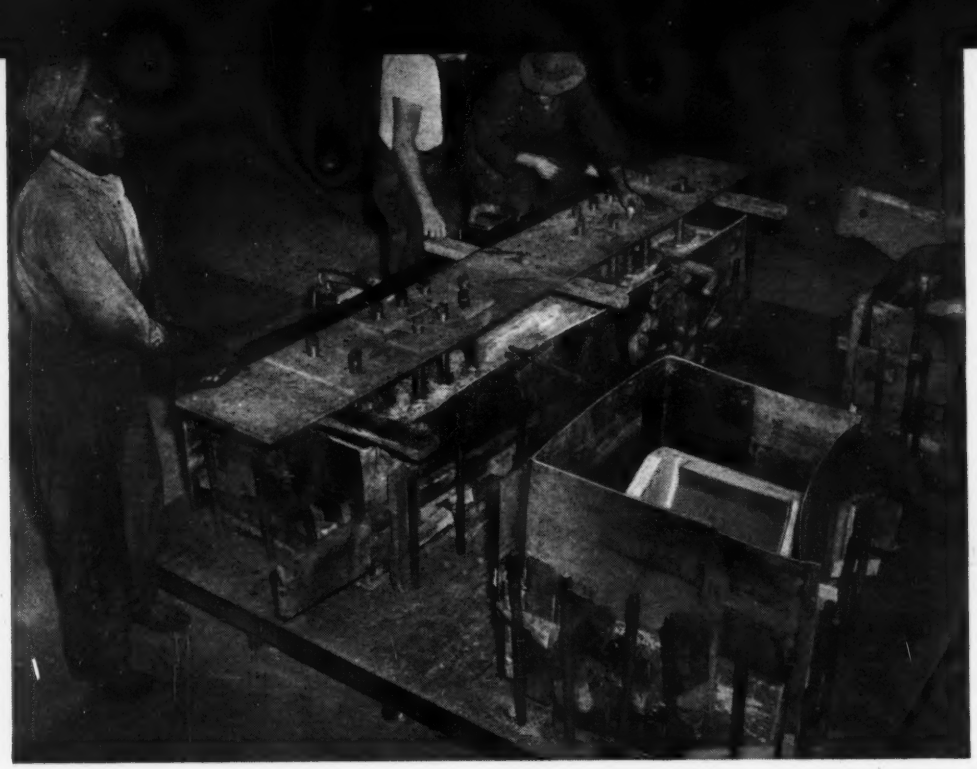


Fig. 8. (Left) Anchor Nuts for Attaching Punches to Cecostamp Hammers are Cast in the Top of the Punches by the Use of a Jig Provided with Long Bolts as Illustrated

Fig. 9. (Below) Kirksite Dies Weighing up to 50 Tons Each have been Produced in the Shop Here Described. Typical Dies Employed on the Cecostamp Hammers are Shown

tern. Reference lines on the mock-up facilitate the development of the templets.

Mock-ups are given several coats of lacquer for protection. When a plaster cast is to be made directly from the mock-up, a mixture of stearic acid and kerosene is applied to the area from which the cast is to be taken, so that the plaster of the cast will remain separate from the plaster of the mock-up. In Fig. 1 a plaster shell cast is seen on the floor directly in front of the mock-up.

In developing the plaster pattern, the plaster cast taken from the mock-up is arranged face upward within a box constructed on a marble surface-plate table, as seen in Fig. 2. A layer of plaster is first poured on the plaster cast to obtain a smooth surface that will be the reverse of the surface on the plaster shell cast. Then more plaster and sisal are added, as shown in the same illustration, to obtain a plaster pattern of substantial thickness. Steel pipes extend longitudinally and crosswise through the pattern for reinforcement purposes. The sides of the box in which this pattern is prepared are positioned at a slight angle to provide a draft on the pattern, which will later facilitate its withdrawal from the sand mold. When the plaster has set for approximately one-half hour, the pattern can be taken from the box ready for use.

Plaster patterns are made hollow, so that they will be easy to handle. Another advantage of hollow patterns is that they show little tendency

to warp. In Fig. 3 is shown a plaster pattern for a roof headlining panel just after the sides of the box in which it was built up have been removed.

In cases where a mock-up is not available for making plaster casts, templets are made from drawings and a plaster counterpart of a mock-up casting is built up on a table. Sides to form a box are arranged around this plaster templet, as in the case of casts taken from mock-ups.

From the plaster pattern a sand mold is built up in a wood flask by conventional methods. However, open-face molds are used, and not the standard cope and drag employed in ordinary molding. Pneumatic rammers are used to tamp the sand in place. Especial care must be taken not to strike the pattern at any point, as breakage may occur. Also, the sand must not be tamped too hard over the face of the pattern. If this is done, the sand may be packed so densely that the gases which occur in pouring the molten aluminum will not be able to escape from the mold and there will be blow-holes in the casting. Albany No. 1 sand, which is about the finest obtainable, is used for these molds. Parting powder is dusted on the pattern surfaces before making the mold, so as to prevent the molding sand from adhering to the pattern.

When the flask has been filled and tamped, a cover board is put on the flask and secured by steel clamps. The flask is then turned upside down and the bottom cover removed to expose the bottom face of the pattern. Draw-bars equipped with turnbuckles are used to withdraw the pattern from the mold. This step in the operation is in progress in Fig. 4. When the pattern has been loosened, it is removed from the mold by means of a crane. The mold is then exposed, as illustrated in Fig. 5.

Kirksite for making the dies and the stretch forms is melted in two Knapp electric-controlled, oil-fired 10,000-pound furnaces of a tilting type. These furnaces are 54 inches in internal diameter. There is a third furnace of the same construction, 48 inches in diameter, which is used for melting lead. Lead punches are generally used with Kirksite dies, except in cases where steel sheets are to be formed or where sharp definition is required. Lead, being softer, conforms readily to the shape of the die in operations on pneumatic hammers. There is, therefore, no need of spotting a lead punch to its die.

The molten Kirksite is taken from the furnaces to the sand molds by crane, as seen in Fig. 5, and poured into the mold through a sprue in the conventional manner until the mold has been completely filled. Pouring is performed slowly. Then the Kirksite casting is allowed to set until it has completely solidified, the time required depending on the size of the casting. Kirksite is next added to compensate for shrinkage and to provide a smooth bottom die surface.

Fig. 10. One of the Cecostamp Hammers Set up for the Production of an Aluminum Wheel Housing from 0.072-inch Thick Sheet

Fig. 11. Another Cecostamp Set-up, which is Employed for Making Front Windshield Stampings. The Windows are Cut out before the Blank Comes to This Operation

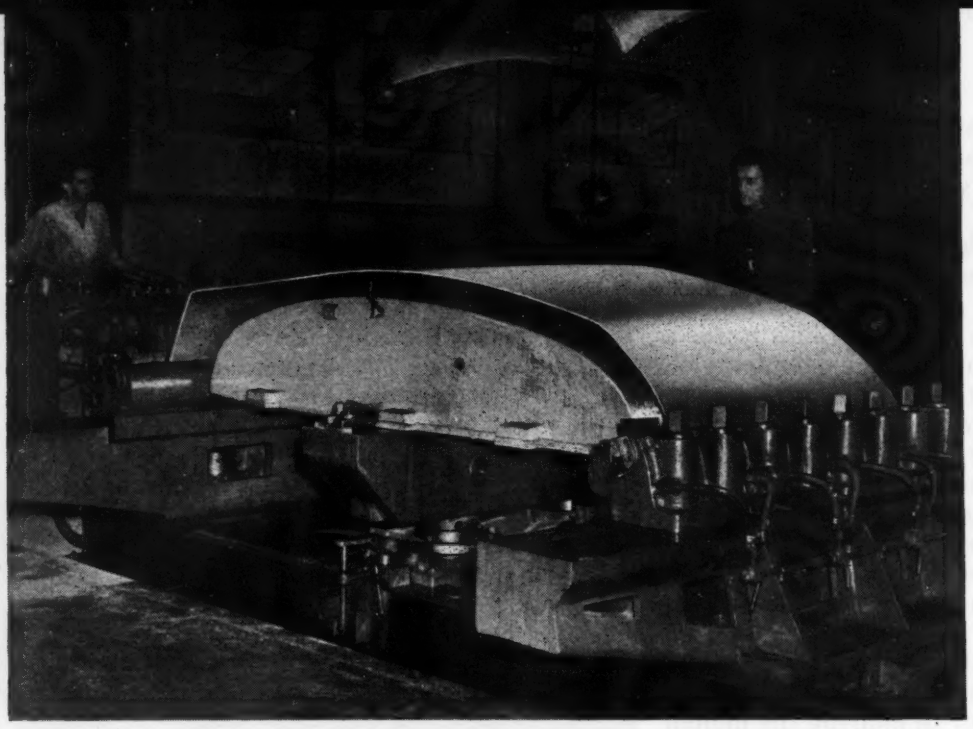


Fig. 12. (Left) General View of the Erco Stretching Machine with a Sheet of Aluminum Ready to be Stretched over the Kirksite Form, and with the Scribing Templet Suspended Overhead

Fig. 13. (Below) Various Bus Parts Produced by the Application of Kirksite Dies on Cecostamp Hammers, the Long Slender Piece being a Front Post Made from 3/16-inch Thick Steel

After the Kirksite castings are taken from the molds, they are transferred to trucks in an adjacent department and smoothed down on all working surfaces by the use of portable grinders equipped with fine-grained abrasive wheels. A minimum amount of cleaning is necessary, and even on large dies, the finishing time is generally not more than from six to eight hours.

Two dies are seen being finished in Fig. 6. From this illustration it will be noted that the dies are cast with holes on two sides that facilitate handling by crane, and also with heavy lugs which are utilized in fastening the dies to the beds of pneumatic hammers and stretching machines. After the working surfaces of the dies have been polished, the dies are transferred to a planer for machining the bottom surfaces.

The finished dies are next set up on a boiler plate, 3 inches thick, measuring 10 feet long by 8 feet wide, for pouring the corresponding punches. Sheets of galvanized iron are arranged vertically around the die to form a suitable enclosure. The sheets are held vertically by means of 1-inch diameter pins of various lengths, as shown in Fig. 7, which are inserted in holes in the boiler plate. These holes are 1 1/16 inches in diameter and are spaced on 2 1/2-inch centers. The galvanized sheets are wedged tightly against the sides of the die to prevent the molten metal, in pouring the punch, from flowing past the joints formed between the galvanized sheets and the die.

The die surface is next coated with lampblack to prevent the metal for the punch from adhering to the die surface. Then, either molten lead or Kirksite, as required, is poured into the galvanized metal enclosure, as seen in Fig. 7, until a punch of the required thickness is formed.

After the punch has been partially poured, a jig for locating anchor nuts in the punch is

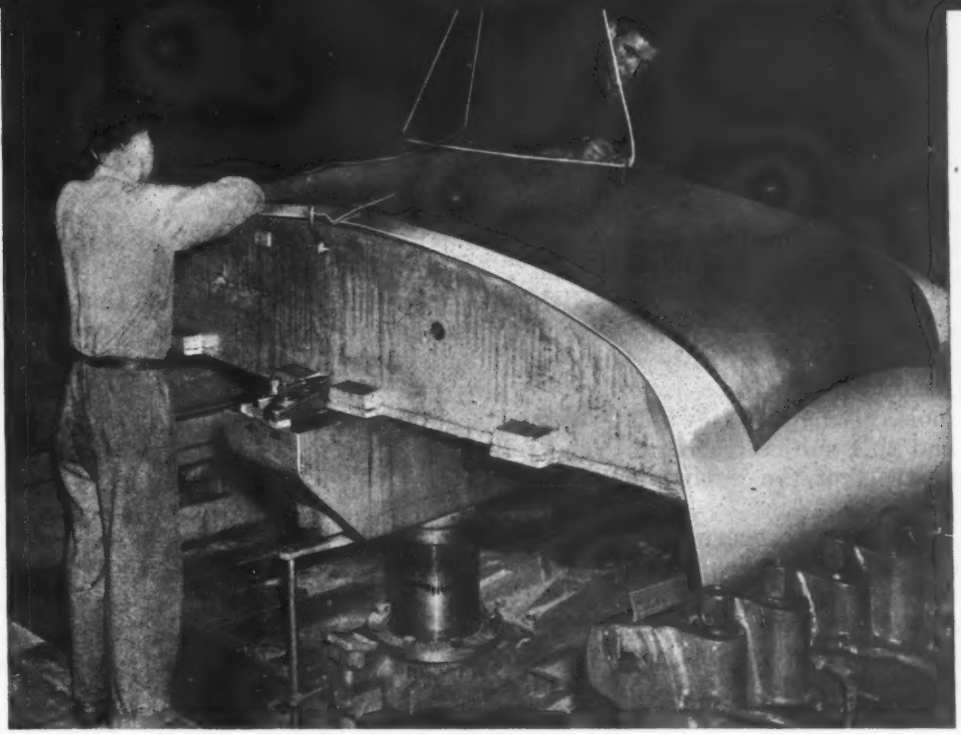


Fig. 14. Machine Shown in Fig. 12, with the Table and Kirksite Form in the Raised Position and the Stretched Sheet of Aluminum being Accurately Scribed by a Templet

placed over the set-up, as seen in Fig. 8. Each of the bolts attached to this jig has a nut screwed on the lower end, which becomes embedded in the Kirksite or lead as it is poured. When the punch has solidified, the bolts are withdrawn, and the anchor nuts left within the casting provide a means of fastening the punch to hammer rams. The bolts that locate the anchor nuts in the punch are tapered to permit them to be easily withdrawn.

Dies weighing up to 50 tons each have been produced by the methods here described for use on a battery of four Cecostamp pneumatic hammers, and forms of comparable size for application on an Erco stretching machine. The Cecostamps range in bed sizes from 36 by 48 inches up to 96 by 120 inches, and the stretching machine has a rating of 150 tons. Typical Kirksite dies made for these presses are shown in Fig. 9. The largest die, seen at the far left, is for forming a bus front roof hood from 0.072-inch thick 61S-O aluminum alloy. The other three dies are for front lower side panels and a front end dasher panel, all of which are formed from 52S-O aluminum alloy. The aluminum alloy sheets drawn, formed, and stretched in this department range from 0.025 to 0.150 inch thick.

The heading illustration shows a rear end lower roof panel being formed on the largest of the Cecostamp hammers. The opening for the window is blanked from the sheet before it comes to this operation, and the sheet is preformed on the stretching machine. Fig. 10 shows one of the other hammers engaged in producing a wheel housing from 0.072-inch thick sheet, while the die in Fig. 11 is employed for making a front windshield stamping from 0.064-inch thick material. Rubber mats are used in some of the press operations to control the flow of metal when there is a minimum of draft and shrinkage on the die members. Rubber mats are mainly required on double reverse curvatures to prevent wrinkles.

In Fig. 13 are shown three additional parts produced on the Cecostamp hammers, as well as a long front cover post made from 3/16-inch thick steel. This piece was bent over a Kirksite form after it had been formed into a channel cross-section on a press brake. The channel measures 2 inches across and the legs are 1 1/2 inches high. The view of the Erco stretching press in Fig. 12 shows this machine with an unstretched sheet of aluminum held in the clamps and with the bed of the machine and the form in the bottom position. The templet used in scribing the stretched sheet to the dimensions required after trimming hangs overhead. Fig. 14 shows the bed of the machine and the form in their raised positions and the aluminum sheet stretched. The templet has been lowered on the aluminum sheet, and the men are engaged in scribing the required outline on the work.

Bus manufacture is neither job shop manufacture nor is it mass production. If buses are produced on a job shop basis, piece costs are prohibitive. On the other hand, tooling on a mass production basis is impossible, since the tool cost per bus in the quantities in which buses are manufactured would still be too high.

A bus presents a complicated tooling problem due to the large number of parts. Consequently, a bus manufacturer must find an "in between" type of tooling which will produce parts accurately to shape so that they are interchangeable and can be assembled easily and economically. It was to solve the problem of forming complicated sheet-metal panels that the Kirksite die set-up was worked out at the ACF-Brill plant.

Putting Surplus Machine Tools to Work

IN an address before the recent annual meeting of the National Machine Tool Builders' Association, William P. Kirk, vice-president of the Pratt & Whitney Division Niles-Bement-Pond Co., and recently elected president of the Association, made a report on surplus machine tools, giving the views of a committee that has had this subject in hand. The following is an abstract of the important points in Mr. Kirk's report.

Everyone concerned in handling the surplus of machine tools is aware of its great importance to the nation. The problem could be so handled as to almost wreck the machine tool industry or it could be so handled as to increase greatly the efficiency of all the vast metal-working industries of the nation. It is, therefore, important that some of the basic requirements relative to the disposal of the surplus machine tools be definitely stated.

Two Basic Requirements of Prime Importance

There are two basic requirements of vital importance. The first is speed. The Government is committed to the removal of these machine tools from the plants of war contractors as quickly as possible, and in any event, not less than sixty days after the termination of the contract; but simply to move the machines out into the open or into makeshift unheated storage sheds will result in serious deterioration.

It is, therefore, recommended that all possible channels of disposal be immediately opened up, and that the procedures of disposal be made just as simple as possible. This means that the cooperation of every branch of industry that can help must be enlisted—the machine tool builders, their sales departments, their dealers, and the used machinery dealers. Under the circumstances, the system of priorities contained in the Surplus Act results in delay and confusion. There will be enough machine tools for everyone. The priorities are unnecessary and hamper speedy disposal of equipment.

The second basic requirement is no less important. The armed services should set up a reserve of machine tools against a possible future emergency. Provisions for this have been made, but the results so far are pitifully inadequate. The industry strained every nerve to provide the machine tools needed to win this war; it took five years. Are we going to dissipate this vast defense potential and face another war emergency unprepared?

Even those authorities who agree with this suggestion assume that a reserve of *special* machine tools designed for war needs is all that is required. They forget the list of critical machine tools that the industry had the greatest difficulty in furnishing in the required quantities to meet the war emergency. This list was one of *standard* types of machines.

Resale Discounts Recommended

The following suggestions with regard to resale discounts are made: The Government's selling prices on machines built during the last three years are now computed according to a formula known as the Clayton formula. These are the "as is" prices to the consumer. Every effort should be made to simplify the procedure, so that any buyer could go to any RFC warehouse, make his selection, pay for it, and haul the machine away.

There are, however, some buyers who will hesitate to buy a used machine directly from a Government agency, and who will wish to enlist the cooperation of a machine tool dealer who can find for him the type and size of machine wanted, see that it is in good condition, and deliver it to the buyer's plant. The sale of machine tools is a technical job, and it is impossible for the RFC to build up a sufficiently large, competent sales staff in this highly specialized field. A resale discount to recognized machinery manufacturers and dealers would enlist these experienced men in the service of the RFC and would greatly assist in the disposal of the surplus equipment economically and in the shortest possible time.

Many customers will prefer to buy from dealers and manufacturers whom they know rather than from a Government agency that has no personal interest in selling "the right machine for the job," nor any responsibility for its future performance. A regulation is now being written to permit resale to dealers and builders at a stated discount—probably 15 per cent. Another regulation that is being considered is to extend the Clayton formula, which now applies only to machines thirty-six months old or less. It could well be extended to machines fifteen years old, so that there would be a fixed price quickly figured for any of them.

Aid of Machine Tool Manufacturers Should be Made Available

Many buyers will also prefer to buy even a used machine from the original builder, so that it will have his endorsement. They may ask the original builder to rebuild the machine and retool it for the work that is to be done on it.

Some procedure, therefore, should be arranged immediately to permit the repurchase by machine tool builders of machines of their own manufacture at negotiated prices, which would enable them to rebuild and resell the machines.

Sales abroad should be handled with care. No surplus machine tools should be shipped out of the United States unless they have been first checked, cleaned, inspected, approved, and, if necessary, rebuilt by the original manufacturer. As yet, no policy has been established to make this possible. The sale of these machines in "as is" condition to foreign countries will undoubtedly have the same effect as after the first World War. Many such machines were then shipped abroad only to be found so defective that they were scrapped instead of being put to use. Since these machines still bear the name of the original maker, his reputation in foreign countries is at stake. The hard-won reputation of American machine tool builders should not be jeopardized by exporting inferior or damaged machines.

Many trade schools and engineering colleges are equipped with a poor quality of machine tools for training boys in the mechanical arts. In any educational institution, the training school is likely to be the most expensive single department; and since schools usually have limited budgets, this condition is difficult to remedy. It is in the national interest that a simple procedure be established immediately so that any reputable educational institution, not operated for profit, can secure the machinery and laboratory equipment it needs at a cost that will not exceed that of boxing plus the necessary transportation charges.

A list of accredited institutions to which this privilege should be extended ought to be in the hands of every RFC field office. Unless the procedure is convenient and simple, many schools will not take advantage of this opportunity to acquire good equipment.

An Opportunity for Eliminating Old and Obsolete Machines

Since machine tool builders are constantly redesigning their machines, the efficiency of the metal-working plants of the country will not be improved if they buy surplus machinery that is obsolete, even though it is sold at a bargain price. It is, therefore, urged that machines over fifteen years old in the Government surplus be scrapped, and not sold to anyone, at home or abroad, as operating equipment.

There are over 600,000 machine tools in the United States that are over fifteen years old. The best use we can make of the Government surplus of modern machines is to replace these obsolete machines. It is, therefore, suggested that an inducement be offered to any manufacturer who will scrap an old machine by allowing him an additional discount from the Clayton price formula for the surplus modern machine that is bought to replace the one that is scrapped.

In conclusion, the necessity for speed in disposing of the surplus is emphasized. Idle machines in warehouses are a liability and a source of expense; put to work, they become a source of employment, produce better consumer goods at lower costs, and thereby help to raise the standard of living.

* * *

Pope Machinery Corporation Celebrates Twenty-Fifth Anniversary

Pope Machinery Corporation, Haverhill, Mass., builder of precision grinder spindles, recently celebrated the completion of twenty-five years of business life at a company dinner at which Francis Healy, chief engineer of the Automotive Division of the Van Norman Co., Springfield, Mass., was the guest speaker. Mr. Healy told of the part Pope spindles had played in the grinding of crankshafts for motors used by Army transportation trucks in China, and of the use of Pope spindles on Van Norman machines in Russia and South America and all parts of North America. Mr. Healy served as a lieutenant colonel of Army Ordnance during the war. Lyman B. Pope, founder and president of the company, traced its growth from an idea to an organization for precision production that delivered thousands of spindles, radar parts, and special aircraft engine milling machines on schedule for vital war production. A number of employes were presented with watches as a mark of appreciation for long service.

* * *

Simplified Practice for Machine, Carriage, and Lag Bolts

The proposed revision of Simplified Practice Recommendation R169-37, pertaining to machine, carriage, and lag bolts, has been approved by the industry committee, according to an announcement of the Division of Simplified Practice of the National Bureau of Standards. This simplified practice became effective October 1, and will be known as R169-45. It is expected that the general use of the simplified lists of recommended standard stock sizes will result in benefits to both manufacturers and users of bolts. Until printed copies are available, a limited number of mimeographed copies of the revised recommendation can be obtained upon request from the Division of Simplified Practice, National Bureau of Standards, Washington 25, D. C.

Brazing Tool Tips to Shanks by Induction Heating

By T. A. VERNOR
and E. F. ADAMS
Westinghouse Electric Corporation
Houston, Tex.

Brazing Tungsten-alloy Tool Tip on Tool Shank by the Use of High-frequency Induction Heat

INDUCTION heating is assuming an important place in many industrial processes because of the tremendous savings in time and the consequent increase in production gained by its use. In the accompanying illustration is shown induction heating equipment recently installed at the plant of the Reed Roller Bit Co., Houston, Tex., which brazes alloy tool tips to single-point tools in a fraction of the time required by the conventional methods formerly employed.

A great number of tools are required at this plant, since the hardness of the product, which is approximately 350 Brinell, causes the tools to break or become dull more quickly than when machining softer materials. With the method previously used, the tool tip was overheated and it took several minutes to braze each piece. Tool tips can now be brazed to a 1 1/2- by 1 1/2-inch tool shank, which is the largest size used, in about thirty seconds by induction heating. Not only is the brazing job speeded up, but the life of the tool is improved, since the tungsten tip and the soft steel shank are heated at different rates, and the tip does not reach the same temperature as the shank, because the power input to a magnetic material is many times greater than to a non-magnetic material of the same flux density. Most of the heat imparted to the tungsten tip is by conduction from the steel tool through the silver solder.

As only about 1 inch of the tool enters the coil, all of the power is quickly concentrated in a small area. This brings the temperature of the shank to about 1400 degrees F. in thirty seconds or less on one end of the tool—depending on the size of the shank—and leaves the other end cool enough to handle with the bare hands.

The work coil for this job was designed to handle several sizes of tools without adjusting the high-frequency generator. This was accomplished by the use of two coils, connected in series. One coil consists of six turns of 1/8 inch copper tubing, 2 by 2 inches on the inside square. The other coil consists of six turns of tubing, 1 1/2 by 2 inches on the inside square. With both of these coils connected to the generator in series, it was found that all sizes of tools could be heated. This method enables the operator to handle several sizes of tools without sorting them by sizes, and increases the flexibility of the equipment.

A safety feature of the tuned plate-coupled grid oscillator circuit used in the generator is the grounding of one side of the work coil, thus putting it at a comparatively low voltage above ground. This is possible since most of the voltage is across the tank coil. The high-frequency generator used is a standard 10-kilowatt, 450-kilocycle set. The power supply is 440 volts, three phase, sixty cycle. Control is by means of a "start-stop" button mounted on the face of the cabinet; additional remote control stations can be provided where required.

On production work of this kind, where a definite time-heat cycle can be predetermined, the automatic timer de-energizes the unit after a predetermined time has elapsed. Protection to the generator is obtained by magnetic type over-current relays in the plate circuit of the rectifier and the grid circuit of the oscillator tube. The main-line circuit-breaker has thermal and instantaneous magnetic overload protection, and the control circuits are fused. The grid-

controlled three-phase rectifier in this unit provides a flexible means for power output control to the work.

After installation and tune up, an inexperienced operator had no difficulty working with the generator, and was soon proficient in using it, both for brazing on new tips and removing those dulled by wear. As a result, the plant has experienced no tool shortage, and one bottleneck in the production line has been broken.

* * *

Government Price Control Has No Place in Times of Peace

Price controls on packaging machinery and food-processing equipment should be removed immediately to facilitate the production and decrease the cost of consumer goods, according to Frank B. Fairbanks, president of the Packaging Machinery Manufacturers Institute, New York City. Mr. Fairbanks said that continuation of price controls would be a tremendous hindrance to reconversion, not only to manufacturers of this type of equipment, but also to customers who need new equipment to increase their production of consumer goods. The removal of controls would permit the development of improved models of much needed machinery, which, in turn, would be reflected in greater production of goods at a decreased cost to the consumer. Ceiling prices on this type of machinery have been frozen at the October, 1941, levels. Since then, according to Mr. Fairbanks, labor costs have increased 35 per cent and material costs 15 per cent.

What Mr. Fairbanks says about packaging machinery applies to practically all types of manufactured machinery equipment, and also to consumer goods, such as automobiles, refrigerators, washing machines, vacuum cleaners, and dozens of other products that are manufactured in great quantities by large and reputable concerns. These manufacturers can be trusted to know how to set equitable prices without assistance from Washington.

Demonstration of Kennamilling

Demonstrations of what is said to be a radically new method of milling, known as "Kennamilling," were witnessed by hundreds of management and production executives at the plant of William Sellers & Co., in Philadelphia, during October. The new process was developed by Kennametal, Inc., Latrobe, Pa., and is applied to a large variety of materials, ranging from steel to magnesium alloys.

On a standard knee type milling machine, S A E 1040 steel was milled with a feed of 26 inches per minute; armor plate parts were straddle-milled with a feed of 17 inches per minute (an interrupted cut being taken in this operation); and 100 cubic inches of Meehanite per minute was removed with a cut 5 inches wide, 0.4 inch deep, using a feed of 50 inches per minute. Dural was milled with a feed of 150 inches per minute, and magnesium alloys with a feed of 300 inches per minute. The surface speed rates for both of these operations was 6300 feet per minute. The finishes obtained in all cases were exceptionally good.

The design and manufacture of a precision tool-holder in the form of a cutter body and the development of a new grinding technique, using a grinding block, made possible a demonstration of a new method of grinding and blade setting. Blades of solid carbide, 5/16 by 9/16 by 2 1/2 inches, were ground in the grinding block which incorporates all angles, both cutting and clearance. The eight blades of an 8-inch diameter face mill were set in less than five minutes. All the blades of an 8-inch face mill were removed, reground, and reset in less than twenty-five minutes. In addition to economy in time for cutter care, the new method is claimed to eliminate all errors of run-out in arbor and spindle.

A Semi-steel Cast-iron Casting that has been Milled with a Kennamill at a Surface Speed of 210 Feet per Minute, a Feed of 20 Inches per Minute, and a Depth of Cut of 5/16 Inch. The Finish Averages from 30 to 40 Micro-inches

How Germany Built Up Its Manufacturing Industries

EARLY in the summer, George H. Johnson, president of the Gisholt Machine Co., Madison, Wis., went to Europe as a member of the U. S. Reparations Commission. Some of his observations were recorded in an address before the recent annual meeting of the National Machine Tool Builders' Association, which is abstracted here.

Mr. Johnson stated that reports obtained previous to his going to Germany estimated Germany's total metal-working capacity at figures that seemed absolutely incredible. It did not seem possible that Germany could be so thoroughly equipped; but after he had seen the German plants and had access to German statistics, he came to the conclusion that these preliminary reports were accurate. Mr. Johnson's impressions can best be conveyed by quoting verbatim some of his statements:

"I think I can best sum up the situation in this single statement: When the war ended, Germany, in spite of all of the bombing of its industrial plants, still had left, in repairable condition, probably more machine tools than we have at this moment in the entire United States.

"When I say machine tools, I mean modern and new machine tools. On the average, German machine tools do not possess the degree of productivity possessed by American makes; but in a number of plants we saw some types of special machines which represented technological developments along certain lines in advance of those thus far made in this country.

German System of Decentralized War Industries

"You may be amazed, as, of course, I was, at the proportion of the German industrial machines that remained operative and undamaged in spite of all the air raids. We estimate that not over 15 per cent were damaged beyond reasonably simple repairs. This does not mean that air raid damage was any less than was reported to us. The air raid damage was enormous, but Germany had integrated its manufacturing operations and worked out a tremendous system of industrial cooperation based on decentralization. In Germany, not all of any one product was ever made in any one plant. Dozens of small plants were making parts, which, when assembled, created the finished product. No one plant represented a key to the whole structure. If one plant was bombed out, there were other plants engaged in doing the same thing that kept on producing.

"Decentralization was not accomplished merely by organizing a system of small plants. The Germans went further than this. They set up individual machines in garages, and even in private homes. All that was needed was a roof, an operator, and electric power, and you had a production unit. Nothing but the complete annihilation of every building in Germany would have destroyed its industrial capacity—and even this would not have been a complete job.

"For, in addition to everything else, the Germans had underground plants. They had duplicate standby plants and specially protected plants, and the entire industrial system was linked up by an interlocking system of electric power. No German city could be put out of commission by destroying its power plant. If a power system was destroyed, a switch was thrown which immediately provided the city with power from the electric power grid that included the whole country.

"This, therefore, is the German machine tool picture—new and modern machines in great numbers spread throughout the country in production units ranging all the way from big factories to tiny home shops and garages. The fact is—and I think we must reluctantly admit it—that we did not destroy Germany's productive capacity. The records prove that the output of many types of war materiel kept on rising right up to the moment of Germany's defeat. Germany was conquered by the shutting off of its petroleum supplies, by lack of man-power, by the excellence of our fighting machine, and by increasing difficulties with raw materials—but Germany was not conquered by the destruction of its machine tool operating plants.

Why Germany Did Not Run Its Plants Two or Three Shifts

"It was surprising to note that Germany did not use the multiple-shift principle of production. Most plants worked one long twelve-hour shift a day, seven days a week. This contrast between Germany and the United States was primarily due to the fact that Germany had many more new and good machines in proportion to its output, and in proportion to its population and the size and scope of its plants, than we have in this country. Hence, even in the face of the most severe threats of defeat, Ger-

many maintained its production by operating its machine tools one shift a day while we were running ours around the clock. What is the answer?

"As the situation was studied, the answer became perfectly obvious. The basic difference was found in the German government's policy with respect to taxation and depreciation as contrasted to the policy of our Government. In this country, it has long been an established Government policy to impose upon industry a low depreciation rate for the writing off of industrial equipment. Obviously, the lower the depreciation rate, the higher would be the taxable income of the company, so that the Government could collect higher taxes.

"Briefly, the United States has not permitted a manufacturer to recover the cost of productive equipment from the income received from the sale of its products, except on a slow and tardy basis. Such depreciation schedules average about twenty years. There were some exceptions to this tax principle during the war, when five-year write-offs were permitted under certain circumstances, but these were exceptions and not the rule.

In the United States, Taxation Policies have Prevented Full Use of Up-to-Date Equipment

"The result has been that in this country Government policies have consistently discouraged the purchase and installation of better productive equipment. We have actually put a penalty upon modernization. It is because of this penalty on modernization that American industry had to go to the principle of multiple-shift operation. For every dollar of profit that we spend on a new machine, we now pay $3 in taxes, and then we are not permitted to recover the dollar in less than twenty years!

"What did the Germans do? Some ten or twelve years ago, they changed their laws with respect to depreciation allowance. At first, manufacturers were permitted to write off the cost of new equipment in a single year. This regulation was later changed, but the manufacturer was still permitted to write off new equipment very rapidly, especially if he scrapped a certain amount of old and obsolete machines. To be sure, some limitation was placed on the percentage of income before taxes that could be used for replacement purposes to be written off at this rapid rate.

"The result of this attitude on the part of the Government was that, once tax penalties upon modernization were removed, German industry immediately modernized and continued to modernize. Since the purchase of new equipment did not represent an overhead burden to the extent that it does in the United States, German industries did not find it necessary to operate equipment three shifts in order to recover from such operation the money needed to carry, and eventually to replace, the equipment. By their system of taxation, they built up a productive capacity sufficient to handle their war requirements on a one-shift basis. There is a lesson for us in this country, and this lesson has to do with preparedness from a national defense point of view.

"A country that has a taxation policy which provides an incentive toward modernization, instead of penalizing it, will not have to worry about preparedness from the standpoint of its productive facilities. An incentive toward modernization is an economic tool of great effectiveness. It was employed by the Germans for purposes of destruction. That does not make the tool any less efficient or important, and I think that this same economic tool might well be considered in this country as a means of obtaining all-out production, full employment, and national defense."

* * *

The Sole Purpose of Industry is to Serve the Consumer

Industry is the servant of the consumer. The sole purpose of industry, both management and labor, is to serve this master—the consumer. This service consists in giving him a better and better product at a lower and lower price. The consumer, or master, rewards this service by paying wages and profits to those in industry. If at any time industry fails in this service, or fails to advance the perfection of this service, the consumer retaliates by eliminating such industry, with its jobs, its profits, and its investment. The recent Labor-Management Conference entirely missed this point.—*J. F. Lincoln, President, The Lincoln Electric Co.*

* * *

Increase in Apprentice Training

The end of hostilities in Europe marked a nation-wide increase in apprentice training in this country for peacetime production. According to figures compiled by the Apprentice-Training Service of the U. S. Department of Labor, 6900 industrial establishments have adopted apprenticeship programs in the five-month period beginning with VE Day (May 8) and ending with October 1—more than double the number adopted during the previous five-month period. The greatest advance in the establishment of apprentice training programs is reported to be in the construction, transportation, and service industries.

Method of Checking Compound Angles

By JAMES AHEARN
Final Tool Inspection Department
Talon, Inc., Meadville, Pa.

THE writer has read with interest the two articles on compound-angle problems* which have appeared in recent issues of MACHINERY. As constructive criticism, he would like to suggest a somewhat different method of checking compound angles than that outlined in the second of these articles. This method has the advantage of not requiring any master blocks or parts. Furthermore, in the method outlined in the May issue, a different master block would be required for each different combination of component angles, whereas in the method to be described, a single set-up will serve to cover any combination of component angles, each of which may range from 0 to 90 degrees.

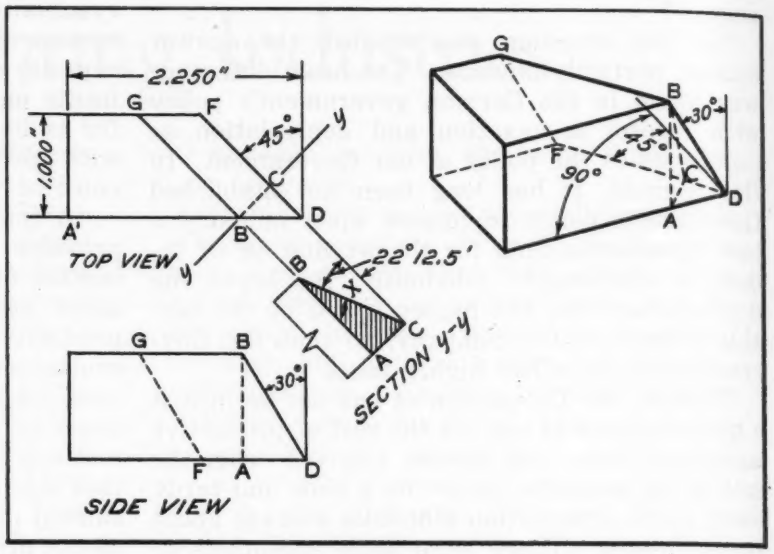


Fig. 1. Top, Side, and Three-dimensional Views of Compound-angle Block, Showing Component Angles in Horizontal and Vertical Planes and the Resultant Compound Angle X

In Fig. 1 is shown the same part as is shown in Fig. 1 on page 158 of the May issue. The plane in which the compound angle is measured, which is perpendicular to the base of the block and to the inclined side *BDFG*, is here drawn as *y–y* through point *B*. This forms the triangular-based prism *ABCD* shown in the three-dimensional view of Fig. 1, each face of which is a right-angled triangle. As can be seen from this diagram, angle *ADB* = 90 degrees — 30 degrees = 60 degrees, and angle *ADC* = 90 degrees — 45 degrees = 45 degrees. The two adjacent right-angled triangles *ACD* and *ABD* containing these known angles have side *AD* in common.

Let the length of side *AD* be considered as unity, or 1; then the unknown compound angle *X*, shown in section *y–y*, is found as follows:

In triangle *ABD*,

$$\text{Tan } ABD = \tan 30 \text{ degrees} = \frac{AD}{AB} = \frac{1}{AB}$$

Therefore,

$$AB = \frac{1}{\tan 30 \text{ deg.}} = \cot 30 \text{ degrees}$$

In triangle *ACD*,

$$\text{Cosec } ADC = \text{cosec } 45 \text{ degrees} = \frac{AD}{AC} = \frac{1}{AC}$$

Therefore,

$$AC = \frac{1}{\text{cosec } 45 \text{ deg.}} = \sin 45 \text{ degrees}$$

In triangle *BAC*,

$$\text{Tan } ABC = \frac{AC}{AB} = \frac{\sin 45 \text{ deg.}}{\cot 30 \text{ deg.}}$$

$$\text{Tan } ABC = \frac{0.70711}{1.7320} = 0.40826$$

Then

$$ABC = 22 \text{ degrees } 12.5 \text{ minutes and}$$

$$X = ABC = 22 \text{ degrees } 12.5 \text{ minutes}$$

With the compound angle known, the pieces can be milled in a universal vise with a stop on the jaw to control the location If a large number of pieces were to be produced, a gang fixture would be made.

For the purpose of discussion, it will be assumed that a high degree of accuracy is required in the finished piece. Thus, supposing the piece in question has been precision ground on a surface grinder, it can be checked very accurately by the toolmaker and the inspector in the following manner:

As shown in Fig. 2, a toolmaker's knee and a sine plate are used to support the work-piece so that its compound-angle face *FGBD* is parallel with the horizontal surface on which the sine plate rests. It will be recalled from the two previous articles on compound angles that the *angle of rotation* is that component angle,

*"Solving Compound-Angle Problems," March, 1945. MACHINERY, page 177; and "Quantity Production and Checking of Parts Requiring Compound Angles," May, 1945, page 158.

one side of which constitutes the intersection of the two planes forming the compound angle. In this instance, the angle of rotation is equal to 45 degrees, as can be seen by referring to Fig. 1.

The toolmaker's knee is, therefore, placed in such a position that one side makes an angle equal to the angle of rotation with the end of the sine plate as shown in Fig. 2. The sine plate is then elevated at an angle with the horizontal equal to the complement of the compound angle, or 67 degrees 47.5 minutes in this case. When the piece is inserted in the angle of the toolmaker's knee as shown, the plane *FGBD* is in a horizontal position.

The first step in checking this piece is to place a steel ball in the pocket formed by the inside faces of the knee and the face of the sine plate, as shown in Fig. 3. The diameter of this ball should be slightly less than twice the thickness of the knee. A smaller ball may be used, but the most accurate reading will be obtained with the largest size ball that will make proper contact with the inside faces of the knee.

The first distance required is the vertical distance from the top of the ball to the inner corner formed by the intersection of the inside faces of the knee and the supporting face of the sine plate. This distance is computed in two steps, as shown by the diagrams in Fig. 4.

The distance *BA'* from the point of contact of ball and sine plate to the inner corner of the knee is first computed. Referring to the plan view in Fig. 4, and assuming that a ball of 1-inch diameter is being used in this set-up, the computation is as follows:

$$BA' = BD \times \text{cosec } 45 \text{ degrees}$$

$$BA' = 0.5 \times 1.41421 = 0.70711$$

View *x–x* in Fig. 4 shows a vertical cross-section taken through the center of the ball and at right angles to the supporting face of the sine plate. This view shows that the required distance *y* is equal to the distance *CB* plus the distance *EF* plus the radius of the ball. This is computed as follows:

In triangle *BA'C*

$CB = A'B \times \sin 67$ degrees 47.5 minutes.

Then

$$CB = 0.70711 \times 0\ 92581$$

$$CB = 0.65464$$

In triangles *BEF* and *BA'C*,

angle *BFE* = angle *BA'C* by construction, and

$EF = FB \times \cos 67$ degrees 47.5 minutes

Then

$$EF = 0.5 \times 0.37797$$

$$EF = 0.18898$$

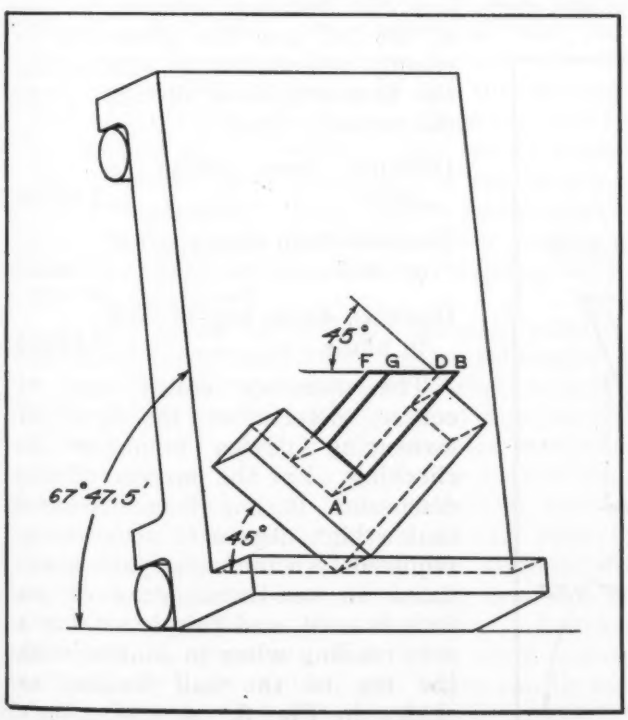


Fig. 2. A Toolmaker's Knee, which has been Swung through the Angle of Rotation on a Sine Plate Elevated to the Compound Angle, is Used to Support the Piece for Checking

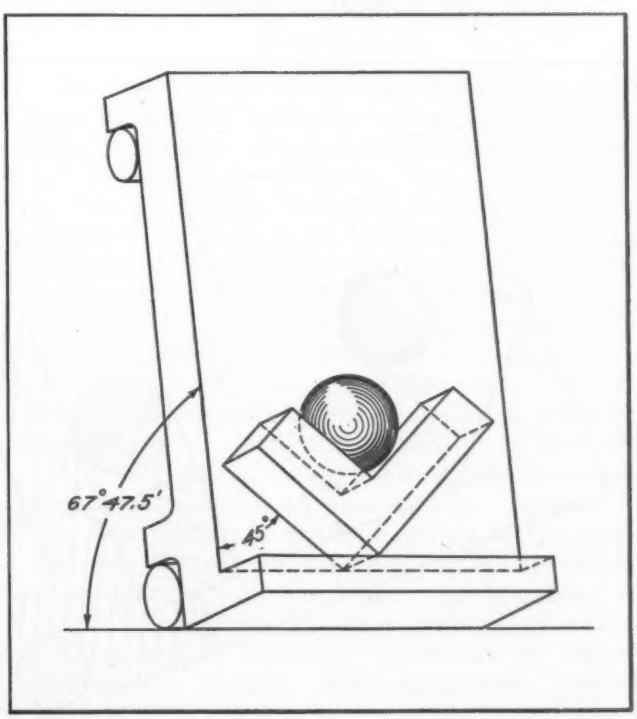


Fig. 3. With the Toolmaker's Knee and Sine Plate in the Same Position as in Fig. 2, a Steel Ball is Inserted in the Pocket Formed by the Angle of the Knee and the Sine Plate

Adding the three elements of y together, $CB + EF +$ radius of ball, we get:

$$y = 0.65464 + 0.18898 + 0.5 = 1.34362$$

The ball is then removed and the compound-angle piece placed in position, as shown in Fig. 2. If, as shown in Fig. 5, a vertical line is now drawn from point A' upward until it intersects an extension of the compound-angle face at G'; and if $G'F'$ is drawn parallel with DB; $G'B'$ is drawn parallel with FD; and lines are drawn from points F' and B' to point A', an inverted rectangular-based prism $A'G'F'DB'$ is formed.

In this prism, $A'D$ is 2.250 inches (see $A'D$ in Fig. 1); angle $F'A'G'$ is the complement of the angle to which the sine plate has been raised, and equals 90 degrees — 67 degrees 47.5 minutes or 22 degrees 12.5 minutes; angle $F'A'D$ equals 45 degrees, since it is in a right-angled triangle and the other acute angle FDA' equals 45 degrees, as can be seen from Fig. 2. The perpendicular distance $A'G'$ is then found as follows:

In right-angled triangle $F'A'D$,

$$F'A' = A'D \cos F'A'D$$

$$F'A' = 2.25 \times \cos 45 \text{ degrees} = 2.25 \times 0.70711$$

$$F'A' = 1.59100$$

In right-angled triangle $F'A'G'$,

$$A'G' = F'A' \cos F'A'G'$$

$$A'G' = 1.59100 \times \cos 22 \text{ degrees } 12.5 \text{ minutes} = 1.59100 \times 0.92581$$

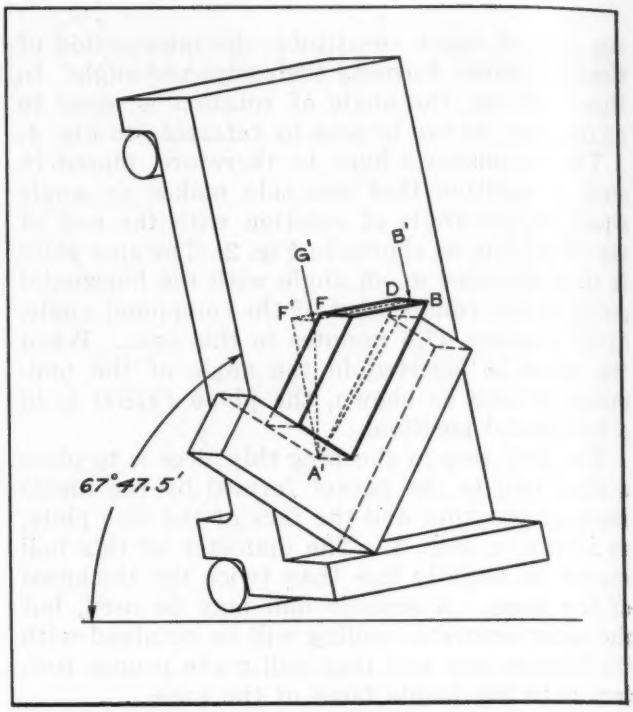


Fig. 5. View Showing Elements Required to Compute Vertical Distance A'G' from Corner of Pocket to Plane of Compound-angle Face

$$A'G' = 1.47296$$

Knowing the vertical distance from the corner of the pocket to the top of the ball and from the corner of the pocket to the plane of the compound-angle face, the distance between the top of the ball and this plane can be readily determined by subtracting the first-mentioned distance from the second. Thus

Distance from corner to plane	1.47296
Distance from corner to top of ball	1.34362
Distance from top of ball to plane	0.12934

The accuracy called for, of course, determines the type of measuring device employed in checking. For the purpose of this discussion it has been assumed that a high degree of accuracy is required. An indicator gage graduated in ten-thousandths of an inch is used, and this is set for a zero reading when in contact with the top of the ball located as shown in Fig. 3. A toolmaker's precision planer gage is then set to the corresponding height. A precision gage-block "build-up" of 0.1293 inch is placed on top of the

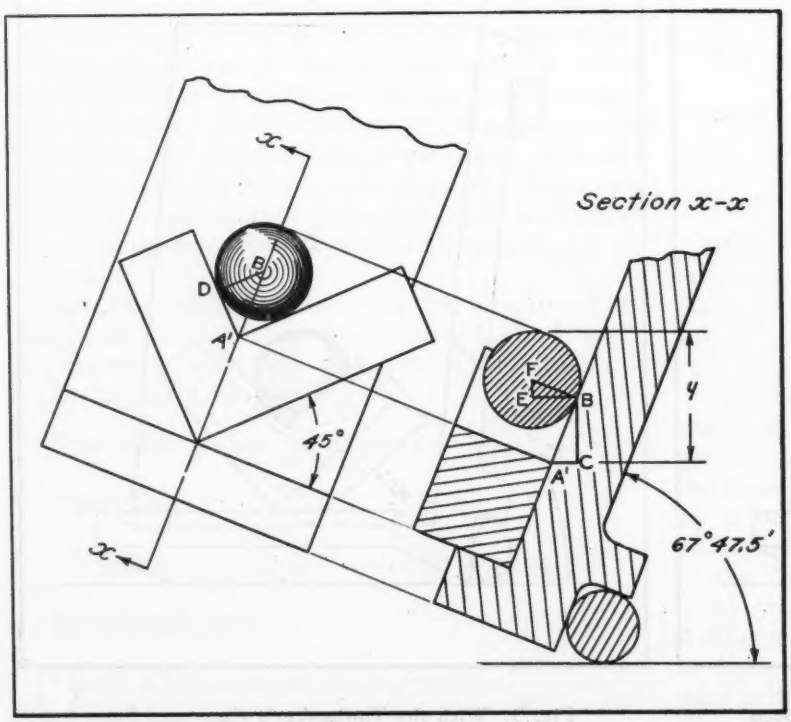


Fig. 4. Diagram Showing Two Steps Required to Measure Distance y from Corner of Pocket to Top of Ball

adjustable head of the planer gage and is wrung to this surface. After rechecking the zero reading on both ball and planer gage, the indicator is then set to read zero on the top surface of the gage-block build-up.

The ball is removed from the knee, and the compound-angle piece is placed in position as shown in Fig. 2. If the indicator maintains a zero reading on all four corners of the compound-angle face *GFDB*, then the 2.250-inch dimension has been obtained and the compound-angle face has been ground to the correct angle.

This particular compound-angle piece should be shown in the position indicated by Fig. 2 in an auxiliary view of the drawing. An outline of the ball should also appear in this view, so that the distance between the top of the ball and plane *GFDB* can be indicated. This view might be somewhat less complicated if the supporting knee were not shown. A drawing of this kind should facilitate accurate checking by both toolmaker and inspector.

A wide variety of compound-angle pieces can be checked by the sine plate within its range of size. It is only necessary to provide locating faces to set the piece at the correct angle of rotation in the knee. The particular piece discussed in this article had locating surfaces at right angles to each other, but a similar set-up could be easily made and the checking carried out in cases where the locating surfaces formed either an acute or an obtuse angle. The type of problem in which the compound angle is formed by holes can also be checked by this method.

Vinylite Plastics—New Applications of a Product of the Bakelite Corporation

ON November 9, the Bakelite Corporation demonstrated to a number of engineering and trade journal editors the processes by means of which Vinylite plastics are being manufactured at the company's plant at Bound Brook, N. J. Vinylite is the trademark applied to a series of thermoplastic resins and compounds marketed by the corporation. These resins were first introduced commercially in the United States about 1926, and since that time have developed into one of the most versatile plastics.

Vinylite plastics belong to the thermoplastic type of materials which are softened by heating but quickly set by cooling. They can be formed and reformed many times by the application of heat and pressure. They possess many valuable properties, such as flexibility, water resistance, acid and alkali resistance, etc., depending on the specific compound.

A long series of intricate chemical reactions produces compounds that can be fabricated in a large number of different forms, including rigid sheets, flexible sheeting, and films as thin as 0.004 inch; molding and extrusion materials; and adhesives and base resins for surface coatings. The fact that these materials are not affected by alkalies, oxidizing agents, most inorganic acids, water, alcohol and aliphatic hydrocarbons, makes them especially desirable for protective purposes of many kinds. Furthermore, with pigments and dyes, they assume almost any color desired, and hence can be used advantageously for innumerable purposes.

The applications range all the way from floor materials to curtains, draperies, upholstery, bathroom and kitchen tiling, parts of radio sets, raincoats, protective coverings of all kinds, footwear, millinery, luggage, belts, and pocketbooks. In industrial applications, this material is used for filters, chemical resistance hose, wire insulation, and many other products, especially in the electrical field.

* * *

Apprentice Training for Returning Servicemen

In reply to the thousands of inquiries from men in service for information on apprenticeship, a booklet entitled "Apprentice Training for Returning Servicemen," has been prepared by the Apprentice-Training Service, U. S. Department of Labor, in collaboration with the educational branches of the War and Navy Departments and the Veterans Administration.

While the booklet is designed primarily for the men still in the service, it is of equal value to those already released from service, and also to employers and labor organizations, especially in gaining a clear understanding of the veterans' legislation as applied to ex-servicemen who are employed as apprentices. Included in the information is an explanation of the financial benefits of the veterans' legislation which supplement apprentice wages; qualifications required of veterans for these benefits, as well as for apprentice training; procedure to follow; application forms; and experience records needed.

Copies of this booklet can be obtained by writing to Apprentice-Training Service, U. S. Department of Labor, 1778 Pennsylvania Ave., N.W., Washington 25, D. C.

Engineering News

Improved Explosive Rivet for Peacetime Mass Production

A so-called "explosive rivet" especially adapted to meet the needs of peacetime mass production has been developed by the E. I. du Pont de Nemours & Co., Wilmington, Del. This improved rivet is the latest development in the explosive type of "blind" fasteners used extensively by the aircraft industry. These rivets are fastened in place by firing a small explosive charge within the shank of the rivet.

The improved design retains the basic features of previous types, but eliminates the necessity for close-tolerance drilling and provides rivets that can be applied to a wide range of metal thicknesses. These features are a distinct step forward, compared with the explosive rivets formerly used by aircraft manufacturers, where precision tolerances and a great variety of lengths were required.

After the explosive rivet is in place, the tip of an electrically heated iron is applied to the rivet head. The heat fires the explosive charge in approximately two seconds. The shank of the rivet is expanded to fill the hole completely, and a barrel-shaped head is formed on the blind end to lock the rivet in place. The holding capacity of these rivets is but slightly less than that of conventional solid rivets.

These rivets are now obtainable in 1/8 inch, 5/32 inch, and 3/16 inch diameters, but later will be available in additional sizes. They are made from various materials, including several grades of aluminum alloys, brass, copper, mild steel, and Monel metal. They will be especially useful in the automotive industries for the construction and maintenance of chassis, bodies, etc. Other applications include cabinet construction for farm and home freezers, locker plants, and commercial refrigerators; prefabricated housing; air-conditioning ducts in the heating and ventilating field; and furnace and stoker fabrication.

Fiberglas "Milled" Fibers – A New Reinforcing Agent

Research now being conducted in the laboratories of the Owens-Corning Fiberglas Corporation and in the laboratories of other manufacturers points to numerous uses for a new material—Fiberglas "milled" fibers—as a reinforcing agent for abrasive compounds and plastics. It is stated that the strength and per-

What is Believed to be the Largest Pressure-cast Rotor for Electric Motors ever Made is Shown to the Left in the Illustration. This Cast Rotor, Made by the Reliance Electric & Engineering Co., Cleveland, Ohio, is 30 Inches in Diameter and is Used for a 250-H.P. Motor for Presses in the Automobile Industry

formance of abrasive cutting wheels have been improved by incorporating 1/4-inch long Fiberglas milled fibers in the abrasive grain, which is then mixed with the thermosetting binder. The addition of the milled fibers is said to have increased by 25 per cent the strength of a 12-inch diameter 1/8-inch thick wheel used to cut off the bead from molded metal products. Maximum operating speeds have also been increased from 15,000 to 17,000 R.P.M. The heat generated is rapidly dissipated.

Permanent Storage of Delicate War Equipment and Instruments

Delicate and expensive war equipment in the possession of the U. S. Government will be scientifically sealed in specially built containers and treated by a recently developed process that will prevent corrosion or other deterioration when not in use. In the past, machinery of this kind had to be greased and stored in warehouses which required maintenance and temperature control. Degreasing for use was also costly.

At the Neville Island plant of the Dravo Corporation near Pittsburgh, Pa., various types of precision equipment, such as height finders, are being stored in all-steel hermetically sealed containers. The size and shape of the container are determined by its purpose. As soon as the equipment has been placed in the container, the latter is completely welded and the air pumped out. Then nitrogen gas is forced in. Nitrogen will not attack the metal or other parts of the apparatus. In addition, silica gel—a chemical dehydrator—is placed in the container. This substance absorbs any trace of moisture which may still be clinging to the inside of the container. It is capable of absorbing many times its own volume of moisture.

Temperature changes varying from 20 degrees F. below to 140 degrees F. above zero will do no harm to the contents of these containers. They can be stored in the open, if necessary, thus eliminating the use of warehouses. These containers can, of course, be used for many other things besides war equipment.

New Corrosion-Resisting Coating for Aluminum and Aluminum Alloys

A new process known as Alumox, for chemically treating aluminum and aluminum alloys so as to produce a corrosion-inhibiting coating, has been developed by the Enthone Co., 442 Elm St., New Haven, Conn. This coating protects the aluminum against corrosive atmospheres, such as salt spray, and also provides an excellent base for organic finishes. The process is said to be particularly suitable for aluminum alloys that do not contain copper. On such alloys, coatings have been obtained with a salt spray resistance of 250 or more hours. The finish obtained is grayish green. The process requires no electric current, and consists merely of immersing the aluminum in a dilute solution of Alumox salts, maintained at a temperature of about 210 degrees F., for two to fifteen minutes.

The "Bounce-Buster" Makes Railroad Cars Ride More Smoothly

A mechanical ride-stabilizer to provide new comfort for railroad travelers by holding the car body in line, despite the jouncing of the wheels caused by track irregularities, has been developed by the Westinghouse Electric Corporation. This device which, in early tests, has shown ability to improve riding qualities more than 2 to 1 over those of cars not so equipped, is a shock absorber of unusually rapid action. In 0.003 second, it sizes up the direction and extent of an impending bounce and counteracts it almost before it gets started.

A sensitive floating weight picks up the first signs of any disturbance that might get through to the body of the car, and acts to increase the oil pressure in a cylinder. The system is so devised that the pumps produce pressure in an expanding, as well as in a contracting, cylinder. This pressure, exerted at just the right time and in the proper direction to oppose the disturbance, will hold the car body still while the wheels move up and down. Cylinders installed horizontally on the car also act similarly to keep the car from swaying from side to side.

Vibro-Levelers Reduce Vibration and Simplify Leveling of Machinery

A line of low-cost, rubber-insulated, dual-purpose machinery mountings for stopping vibration and for leveling machinery has been developed by Bushings, Inc., Royal Oak, Mich. The new mountings, known as "Vibro-Levelers," are made in nine sizes ranging in load capacities from 10 to 2000 pounds. They are especially intended for application to punch presses, compressors, blowers, forging hammers, and grinding and buffing machines. Designed so that they can be installed quickly, with no floor cutting or fitting, they can be used on either new or existing equipment. Brackets available in various capacities permit installation of the mountings without materially raising the height of the machine. The insulating material is synthetic rubber, which is not attacked by oils or greases.

Although generally available in sets of four, these machinery mountings can be used in any number required for different types of machines.

Editorial Comment

Individual initiative has made America what it is. From the day of the Pilgrim Fathers up to the present war period, with its unprecedented production record, individual initiative has stood out as the primary fact in American life. It has made America a leader in most industrial fields and created a standard of living that has not been equalled elsewhere.

A man named Woolworth, with a few dollars in the bank, had an idea for a new kind of store. He risked his small capital, succeeded, and lived to build not only the largest merchandising chain of stores of his day, but also what was then the tallest building in the world. A factory worker named O'Sullivan bought a rubber mat to stand on, because he did not like the vibration of the floor. Another worker liked the idea and stole his mat. O'Sullivan got another mat, but cut out a couple of pieces from it which he tacked to the heels of his shoes. Today almost all America wears O'Sullivan's, or somebody else's, rubber heels.

Initiative and Enterprise are the Cornerstones of Industry

Thus individual initiative has created thousands of businesses, large and small. In the machinery field, the examples are too numerous to mention. Almost every one of our leading machine tool builders can point to a very small beginning, founded on the enterprise of a man with initiative and imagination. It is a mistaken notion that new businesses are generally started by wealthy men with ample capital. A few of them are; most of them are not.

A serious question is now before the American people: Is this the kind of America that we shall have in the future? Shall individual initiative and enterprise have an opportunity to forge ahead? Shall men with vision and energy be permitted to conduct their own business in an efficient manner, so that they may continue to build on the foundations laid by men of initiative and enterprise in the past? Or shall we succumb to a bureaucratic socialism, where our every business move is directed and supervised by a Government agency? Shall the employer have the same right to choose who shall work for him as the employe has to say whom he wants to work for? Shall men again be able to call their business their own, or will the Government assume control to such an extent that it determines 90 per cent of the policies and takes away in taxes 90 per cent of the financial returns?

Shall We Tear Down what the Past Has So Carefully Built?

▼ ▼

Frequently we meet an engineer who has done some remarkable research work, the results of which are in no sense a trade secret, but are of interest and value to industry at large. When it is suggested that his findings ought to be placed on record in published form, he replies that his findings are not yet as complete as they will be in six months, and he considers it advisable to withhold publication until that time.

The wisdom of this policy may well be questioned. Industry can never wait for perfection. Had industry waited for perfection, little or nothing of the marvelous achievements of the last hundred years would have been accomplished. Of course, there is always more to be found out on almost any subject than that which is known today, but a real service is rendered by recording what is known to date. New discoveries are always being made; and even at the time a treatise recording important research work is on the press, still more is being found out about the subject. All engineering articles, all papers read before engineering societies, must be considered as progress reports; they are never final.

Industry Must Use Today's Knowledge. It Cannot Wait

The mechanical industries must work with what is known today; we cannot wait for what may be discovered tomorrow. Many an engineer has failed to take advantage of today's knowledge because he thought he could do better if he waited for tomorrow's discoveries. But tomorrow he will be no better off, because the day after tomorrow will see still more remarkable discoveries. The object of the technical press is to record present knowledge, even though incomplete. The more we discuss a problem, the sooner we are likely to find the best solution.

Production is the Main Foundation of Maximum Employment

IN an address entitled "How to Create Jobs in a Free Economy," made at the recent annual meeting of the National Machine Tool Builders' Association, Joseph L. Trecker, executive vice-president of the Kearney & Trecker Corporation, Milwaukee, Wis., and now past-president of the Association, clearly demonstrated the importance of a high level of production if there is to be a high level of employment. He took issue with the New Deal and labor-union doctrine that curtailed production creates more jobs. The importance of this subject at the present time warrants abstracting the main parts of Mr. Trecker's address, from which the following paragraphs are quoted.

"When I say 'how to create jobs in a free economy,' note that I say 'in a free economy.' It is a simple matter to create jobs under a dictatorship. Germany created jobs and Russia created jobs by simply ordering people to go to work as directed by the Government; but I am talking about a system of government under which a man is free to choose the type of work he thinks he wants and to compete with other people for that job.

"If past history is any guide, I think we can lay down the premise that the operation of the competitive system leads to the creation of jobs. I think that this has been instinctively recognized by most of our people and has been reflected in our laws against monopoly.

How Competition Creates Jobs

"Competition creates jobs because, through competition, we are constantly endeavoring to offer better things at lower cost to more people. How is this accomplished? It is done by the use of productive equipment which increases the output of the individual worker. In other words, men and machines become partners in multiplying the output.

"It is not generally understood that this is a new principle in civilization. Before the advent of productive equipment as we now know it, this principle did not apply. In my opinion, it is the failure of industry to educate the public to an understanding of the basic economics behind volume production that has led to much of our present social unrest.

"When a company by the aid of good machine tools and other productive equipment can cut the cost of its product, it can offer that product at a lower price. As the price goes down, its market increases; and as its market increases, its sales volume goes up. Finally, as the sales volume goes up, it can hire more men. That is how more jobs are created.

"Machine tools and other productive equipment come into this picture because they reduce costs. They reduce costs by increasing the productivity of the individual worker; and so we arrive at the fundamental principle that jobs are created by increasing the productivity of the individual worker; and so we arrive at the fundamental principle that jobs are created by increasing the productivity of the worker. This is a point that industry has thus far failed to present clearly. The New Deal and the labor unions have put forward an absolutely contrary idea. It is our business to show the fallacy of that point of view.

It is the Man of Initiative that Creates Jobs

"Sociologists are always fond of talking about minimum requirements of a decent existence; but, as a matter of fact, most of the employment in our country has been founded, not upon the things that people *had to have*, but upon things that people *wanted* over and above the necessities of life. People lived perfectly well before they had automobiles, radios, refrigerators, and vacuum cleaners. Those things do not represent necessities of life. In fact, people lived perfectly well before they had telephones and electricity. All that people really have to have is adequate food, shelter, and clothing.

"The great industries of our country, and the employment that has resulted from the initiative of their founders, have become great by making things that people wanted rather than things that they really had to have. All the jobs in those great industries were created jobs. This point should be emphasized. They were created by inventors, engineers, and practical production men who contrived to satisfy human desires at prices that people could afford to pay.

"Look forward. What about television, the helicopter, and hundreds of other new devices that are in the offing? These devices do not represent human needs, but every one of these new ideas will result in creating jobs. They will create more jobs provided the cost of the product can be brought within the reach of the average pocketbook, and this can be done by men and machines working together on a basis of maximum productivity.

Output — Not Hourly Wage Rates — Measure a Man's Value

"The idea of hourly wage rates arose back in the days when time was in fact at least a fair measure of productivity. That assumption no longer applies. The labor-union principle is that there is only so much work to be done, and that unless it is spread out to the greatest possible extent, there will not be enough jobs to go around. This is in direct conflict with industry's concept of creating jobs. The union idea is that by limiting productivity more jobs can be maintained. Industry's idea is that by increasing productivity, not only can more jobs be maintained, but additional jobs can be created.

"The left wing of organized labor in the United States has often expressed a strong leaning toward the Russian system of regimentation, as contrasted with the American system of competition; but in Russia today, workers in most cases are paid on the basis of productivity per hour. The incentive system so generally objected to by organized labor in this country is for the most part in full effect throughout Russian factories. It is certainly a paradox that Russia, under a system of regimentation, accepts and utilizes the principle of maximum productivity, while in America, where the whole preservation of our social economy depends upon the acceptance of that principle, organized labor is proceeding in exactly the opposite direction.

How Government has Jeopardized Job Security

"Industry cannot guarantee job security to anybody, but industry can teach the principle that productivity is the key to steady employment. It is a principle that is not easily taught, because ever since the advent of the New Deal practically every move taken by industry leading toward greater employment as a result of greater productivity has been opposed by the Government.

"By the application of its depreciation policy, the Government imposed a penalty upon the installation of productive equipment. By its tax policy, the Government has made it more difficult for industry to retain out of its earnings, the money needed for plant modernization. The Government has encouraged labor unions in their philosophy of restraining productivity and in the idea that pay should be for hours of work instead of for work performed. And, finally, the Government has upheld the practice of labor unions of breaking contracts and thereby interrupting production.

"To combat these erroneous doctrines, industry must present an ideology and 'sell it' to the public and the Government. This ideology is based in the main on the following premises:

"1. We can increase employment in this country only in proportion to productivity.

"2. Productivity can be increased only by the increasing utilization of machines that enable the worker to multiply his own output.

"3. The pay that the worker gets should be related to his output, rather than to the time clock.

"4. Taxation policies should be revised so that there will be an incentive, instead of a penalty, for the installation of equipment that will lead to greater productivity.

"Unless the philosophy of limited productivity can be defeated we stand to face, in this country, a steady decline in the invention and development of new devices and new equipment, a slowing down in scientific advancement, and a retrogression in our standard of living. In my opinion, the future of industry depends upon the extent to which our people and our Government come to understand and support the principle of productivity as the basic foundation of maximum employment."

* * *

New Electric Welding Process Eliminates Residual Stresses

A new technique in spot welding which is said to achieve the closest practical approach to cold welding yet obtained has been developed by the Metallizing Co. of America, Industrial Division, 1330 W. Congress St., Chicago 7, Ill. This development, called the "Mogul Dot-Weld" process, is designed to eliminate residual stress and contraction resulting from high-temperature welding. In applying this process, the new "Mogul Quench Arc Weld" machine is used with the unique "Dot-Weld" pistol.

By the use of this equipment, penetration depths of from 0.001 up to 1/32 inch are obtained; yet all danger of the development of high heat volumes in the base metal and consequent heat distortion and residual stresses is said to be eliminated. This is accomplished by the specially designed air-pressure unit built into the Dot-Weld pistol, which quenches the electrode and the arc in a constant stream of cooling air. The Mogul welding machine, which operates on alternating current, supplies the pistol with the required high-amperage, low-voltage current.

The process is being used successfully for the low-cost salvage of ferrous and most non-ferrous castings rejected because of blow-holes and other defects, by providing a readily machinable fill-in deposit of aluminum, bronze, nickel or zinc, which can be quickly applied to any metal. In addition to its application to the repair of castings, the process is used for repairing metal patterns, cracked engine blocks, etc.

Design of Tools and Fixtures

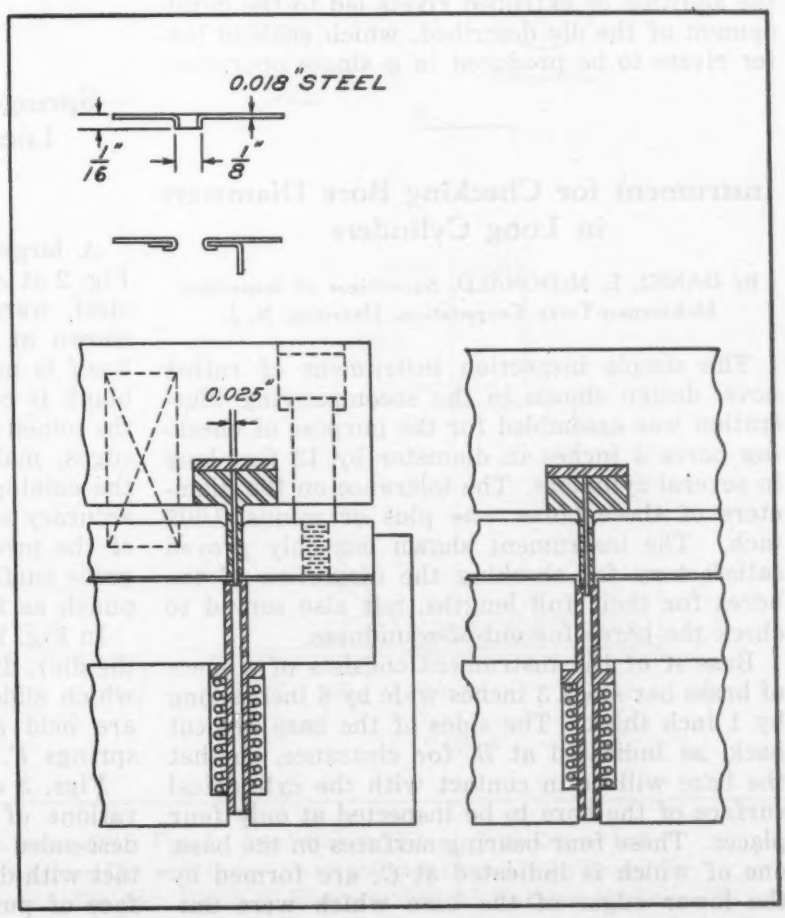
Die for Forming Extruded Rivet in Sheet-Metal Plate

By WALLACE C. MILLS, Rockford, Ill.

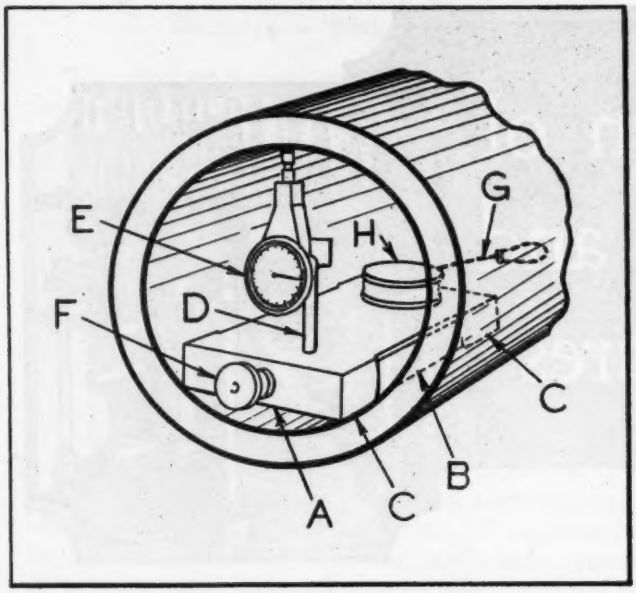
The die here illustrated was designed for forming an extruded rivet in a thin sheet-metal plate. The rivet, which is integral with the plate, is shown in the views at the top of the illustration before riveting and after riveting to another piece of sheet metal.

A satisfactory rivet of this type and one presenting a good appearance should be small in diameter, the flange should be high to allow sufficient stock for riveting, and the edge of the flange should have no cracks in order to avoid tearing when the flange is riveted. These requirements are best met by perforating a very small hole and then expanding the metal around the hole to form the flange. It would be possible to produce a rivet by piercing the metal with a sharp-pointed punch without cutting out a slug, and expanding the surrounding metal with the same punch, but the edge of the flange in this case will be ragged and torn after riveting.

The die illustrated pierces a small hole with a clean-cut edge and expands the flange in the same operation. The perforating punch is made of 0.025-inch music wire, hard soldered into the supporting extruding punch. The perforating punch cuts against a sliding die bushing which is supported by a strong spring. The perforated slug drops out of the die through the bushing. After perforating, the punch continues to descend and the surrounding extruding punch expands the flange and at the same time pushes the sliding bushing down. On the up stroke of



Die Designed to Extrude Hollow Rivet in Sheet Metal, as Shown in Upper Left Corner of Illustration



Equipment for Checking Bore Diameter of Long Tubes

the press, the spring-actuated bushing lifts the work out of the die. Although it is not usually desirable to pierce or cut on a die supported by springs, it was found practical to do so in this case with a punch having a diameter of only 0.025 inch.

The problem of changing two dies for a radio panel which had been hardened to provide for the addition of extruded rivets led to the development of the die described, which enabled better rivets to be produced in a single operation.

Instrument for Checking Bore Diameters in Long Cylinders

By DANIEL E. McDONALD, Supervisor of Inspection
McKiernan-Terry Corporation, Harrison, N. J.

The simple inspection instrument of rather novel design shown in the accompanying illustration was assembled for the purpose of checking bores 4 inches in diameter by 13 feet long in several cylinders. The tolerance on the diameters of these bores was plus or minus 0.002 inch. The instrument shown not only proved satisfactory for checking the diameters of the bores for their full lengths, but also served to check the bores for out-of-roundness.

Base *A* of the instrument consists of a piece of brass bar stock 3 inches wide by 6 inches long by 1 inch thick. The sides of the base are cut back, as indicated at *B*, for clearance, so that the base will be in contact with the cylindrical surface of the bore to be inspected at only four places. These four bearing surfaces on the base, one of which is indicated at *C*, are formed by the lower edges of the base which were uniformly rounded to a slight radius before the relief sections *B* were machined. The steel post *D*, located 1 3/4 inches from the end of the base, carries a midget dial indicator *E*, which is secured to the post by a knurled-head screw. Post *D* is adjustable in the base *A*, and can be securely fastened to it by the locking screw *F*.

The first step in using this instrument is to carefully measure the bore to be gaged near one end, using a micrometer to determine its exact size as accurately as possible. The instrument is then placed in the bore with the dial contact point in the same position occupied by one contact point of the micrometer employed in measuring the bore diameter. The dial gage is then adjusted so that its pointer is turned to the zero mark. The instrument is then pulled slowly through the bore by means of a string *G* while any variation of the dial pointer from zero is observed through a transit telescope, a spot flashlight being used to illuminate the dial. The transit telescope is mounted on a tripod and is kept focussed directly on the dial indicator.

After pulling the instrument through the bore, the cylinder is rotated through an angle of 90 degrees and the gaging operation repeated. Thus the amount of out-of-roundness, as well as variations in diameter, are obtained by recording the dial readings. The string *G* used to draw the instrument through the bore is wrapped around the small brass drum *H* when not in use.

Spring-Actuated Receding Guides for Locating Work in Coining Die

By L. KASPER, Philadelphia, Pa.

A large number of disks such as shown in Fig. 2 at *A*, which had been stamped from sheet steel, were required to be coined to the form shown at *B*. Although the coining operation itself is not unusual, the fact that the stamped blank is considerably smaller in diameter than the coined piece and is reduced in thickness at the edges, makes the locating of the blank under the coining punch with a reasonable degree of accuracy somewhat of a problem. The solution of the problem was accomplished by providing guide surfaces which withdraw from under the punch as the latter descends.

In Fig. 1 (which shows plan and end views of the die), disk *A* is located by the three guides *E*, which slide in plate *D*, fastened to die *G*, and are held at their inner positions by the flat springs *F*.

Figs. 3 and 4 are partial sectional front elevations of the die. In Fig. 3, punch *C* has descended to a position in which it is in contact with disk *A*. At this point, the angular surface of punch *C* has come in contact with the

angular surfaces on the inner ends of guides *E*. From this point until the completion of the stroke, disk *A* cannot move out of position, as it is held by punch *C*. It will be noted that the inner ends of guides *E* which come in contact with disk *A* are reduced in thickness. However, they cannot be reduced in thickness to an extent that will permit the guides to remain in position until the end of the stroke. Therefore, they are caused to withdraw by the action of the angular surface of punch *C* on the angular surfaces of guides *E*.

In Fig. 4, the ram has completed its stroke. It will be seen that guides *E* have been withdrawn to a point outside of the working surface of punch *C*. On the up stroke of the ram, the coined piece *B* is removed and guides *E* return to their original positions, as in Fig. 1.

Simple Gage for Checking Pump Gears

By G. A. ALMORTH, Tool Engineer
Pratt & Whitney Division
United Aircraft Corporation, East Hartford, Conn.

The gear testing fixture illustrated on the following page, when used with a comparator, is believed by the writer to provide a much simpler, more accurate, and faster method of checking the pitch diameter of the pump gear *A* within certain limits than is possible with the dial indicator type of fixture shown on page 177 of January, 1945, MACHINERY. The length of the tooth and outside diameter are checked by turning the part while it is located in the position shown in the illustration. For checking the pitch diameter and run-out, holder *D* is given

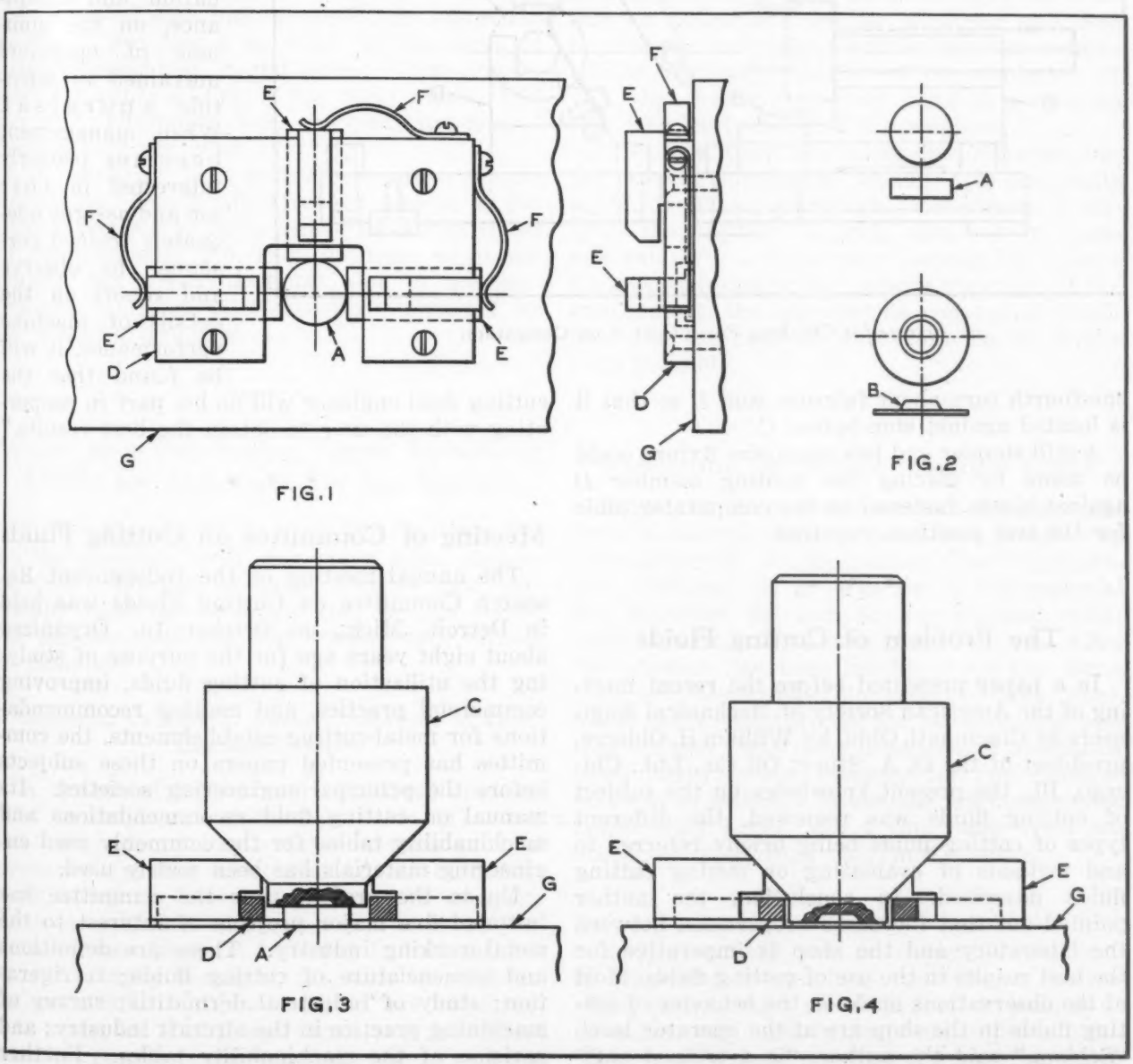
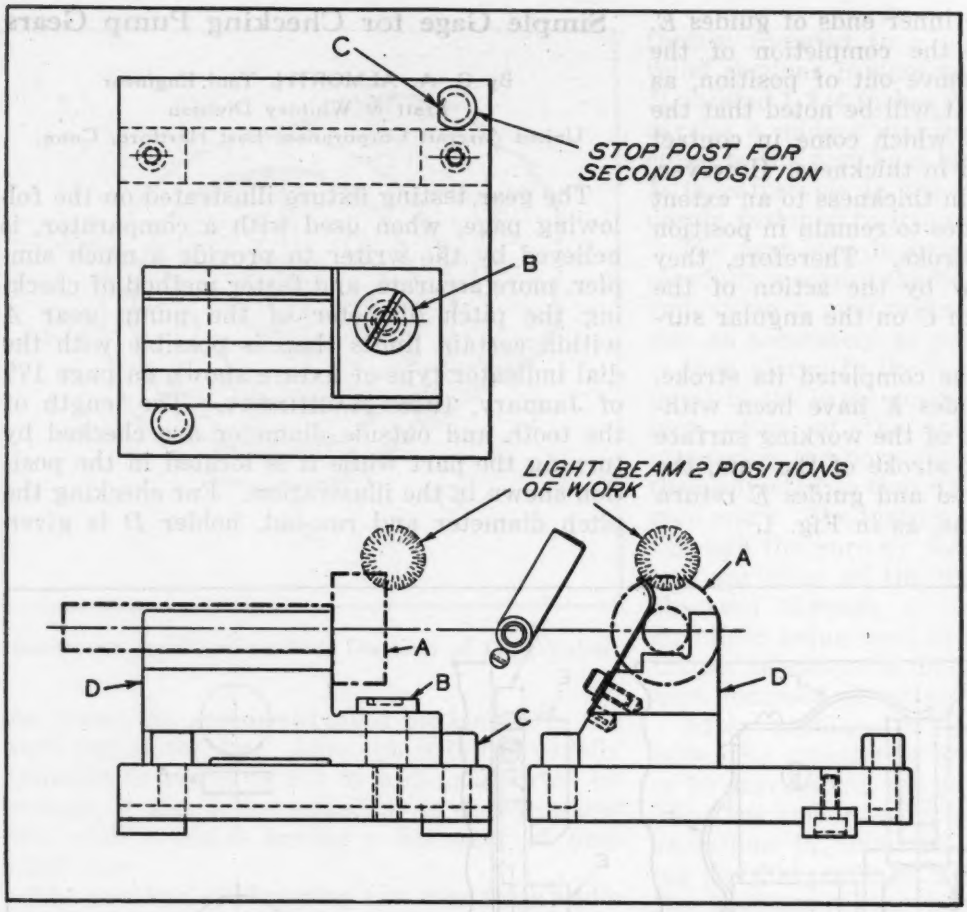


Fig. 1. Plan and End Views of Coining Die. Fig. 2. Steel Disk A Coined to the Shape Indicated at B by Punch C. Fig. 3. Coining Die with Disk A Centered under Punch C by Spring-actuated Guides E. Fig. 4. Coining Die with Punch C Shown at End of Working Stroke



Fixture for Checking Pump Gear A on Comparator

one-fourth turn about fulcrum stud *B* so that it is located against stop-button *C*.

A still simpler and less expensive fixture could be made by placing the holding member *D* against blocks fastened on the comparator table for the two positions required.

* * *

The Problem of Cutting Fluids

In a paper presented before the recent meeting of the American Society of Mechanical Engineers at Cincinnati, Ohio, by William H. Oldacre, president of the D. A. Stuart Oil Co., Ltd., Chicago, Ill., the present knowledge on the subject of cutting fluids was reviewed, the different types of cutting fluids being briefly referred to and methods of evaluating or testing cutting fluids described. In conclusion, the author pointed out that increased cooperation between the laboratory and the shop is imperative for the best results in the use of cutting fluids. Most of the observations made on the behavior of cutting fluids in the shop are at the operator level. "Seldom," said the author, "is a trained engineer assigned to observe and record operating results, and even more rarely are adequate time and assistance provided for this important job." The makers of cutting fluids are often accused of neglecting basic facts and of employing high-pressure salesmanship. "Perhaps," said the author, "there is more than a little basis for this accusation, but it must be kept in mind that the oil company's product must meet the tests of actual operations and that it is largely dependent, for evaluation and acceptance, on the opinions of operators untrained in scientific appraisal. When management becomes properly interested in this job and assigns adequately trained personnel to observe and report on the details of machine performance, it will be found that the cutting fluid engineer will do his part in cooperating with the user to obtain the best results."

* * *

Meeting of Committee on Cutting Fluids

The annual meeting of the Independent Research Committee on Cutting Fluids was held in Detroit, Mich., on October 10. Organized about eight years ago for the purpose of studying the utilization of cutting fluids, improving commercial practice, and making recommendations for metal-cutting establishments, the committee has presented papers on these subjects before the principal engineering societies. Its manual on cutting fluid recommendations and machinability tables for the commonly used engineering materials has been widely used.

Up to the present time the committee has initiated five major projects of interest to the metal-working industry. These are definitions and nomenclature of cutting fluids; refrigeration; study of industrial dermatitis; survey of machining practice in the aircraft industry; and revision of the machinability tables. Further information on the work of the committee can be obtained from Joseph Geschelin, chairman, 1015 Stephenson Bldg., Detroit 2, Mich.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Machine-Tool Cast Iron

A. C.—What composition of alloy cast iron will give maximum resistance to wear combined with high strength when used for machine tool wearing surfaces?

A.—According to *Nickel Cast Iron News*, published by the International Nickel Co., Inc., New York City, the Covel Mfg. Co., Benton Harbor, Mich., uses, in its hydraulic surface grinders, an alloy cast iron that has given great resistance to wear coupled with high strength. A typical analysis of this cast iron, used for the ways of grinding machines, is as follows: Total carbon, 3.20 per cent; silicon, 2 per cent; nickel, 1.50 per cent; chromium, 0.50 per cent, and molybdenum, 0.30 per cent.

All castings are normalized after rough-machining. The tensile strength exceeds 40,000 pounds per square inch, with a Brinell hardness of approximately 235. This cast iron, when machined, has a smooth finish, due to the fine-grained, uniform microstructure imparted by the alloying elements.

When is a Purchasing Agent Personally Liable for Contracts He has Signed?

P. F.—Please give us some legal information on the question when and under what circumstances a purchasing agent may be held personally liable on contracts that he has signed for his employer, but that his employer refuses to complete.

Answered by Leo T. Parker, Attorney at Law Cincinnati, Ohio

A review of higher court decisions discloses that an employe is personally liable (1) when he knowingly makes a false written or oral statement, or representation of his authority, with intent to deceive a person who transacts business with his employer; (2) when he performs a damaging act believing he had authority, but actually has none; (3) when he performs unlawful acts with authority of his employer; (4) when he wilfully performs any fraudulent act that results in damage to anyone; (5) when he performs damaging acts outside his scope of authority, although he intends to render his employer a valuable service; and (6) when he intentionally assumes an obligation for his employer.

Stating the same rule of law differently, an employe may be personally liable on contracts made for his employer (1) when he makes a false statement or representation of his authority *with intent to deceive;* (2) when he *knowingly* makes a false statement or representation without intent to deceive; (3) when he does a damaging act, believing he has authority, but actually has none; (4) when he acts on authority from his employer and does an unlawful act; (5) when he assumes responsibility without authority of his employer; or (6) when he signs his own name to a contract without clearly binding his employer.

Therefore, there are many circumstances under which purchasing agents are personally liable for affixing signatures to contracts. Sometimes the employer is liable, also, but as a general rule, where an employe exceeds his authority and performs an act outside the scope of the employment, the employer is relieved of liability. See the case of Kidd-Russ Co. v. Meyer [123 So. 506].

* * *

Meehanite for Screw Machine Cams

Automatic screw machine cam blanks made from Meehanite castings have been found very satisfactory by the Instrument Parts Corporation, Ossining, N. Y. The use of this material has increased the cam service life and maintained accuracy for a long period of time. After the contour has been machined on the cams, they are heat-treated to assure longer wear. These cams pass through the heat-treating process without distortion. Heat-treated Meehanite cams lasted in one instance for two hundred hours of operation. Meehanite not heat-treated lasted sixty hours, and a cam made from another material lasted only thirty hours.

* * *

To do anything new or original—whether it is composing a symphony, painting a masterpiece, uncovering a scientific fact, or making an invention—we must be prepared to pay a price. That price is made up of hard work, disappointments, criticisms, and often physical as well as mental discomforts.—*C. F. Kettering, Vice-President, General Motors*

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

New Free-Cutting Copper Rod Saves Machining Time

A free-cutting copper rod of the tellurium bearing type with greatly improved machinability is now being made by Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y. This rod is produced from oxygen-free, high-conductivity copper containing a small amount of tellurium, which greatly increases the speed of machining the metal and makes possible closer tolerances and a better finish of the completed parts. In machining, brittle chips are produced, which break away readily from the tools without requiring attention, in contrast to the long, tough stringers characteristic of electrolytic copper.

In one case, the use of this product permitted an increase in spindle speed from 924 to 1161 R.P.M., and in feed from 0.0065 inch to 0.0105 inch per spindle revolution. This resulted in a saving of 42 per cent in the time required to produce the part. 201

Non-Flammable Thermosetting Plastic Developed by Goodrich

High optical and electrical properties, good resistance to abrasion, and high resistance to oils, greases, and most chemicals, including acids and alkalies, characterize a new non-flammable thermosetting plastic developed by the B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, Ohio. This material, named "Kriston," is the first of the new post-war products to be announced by this company.

"Kriston" monomer is a somewhat viscous, anhydrous liquid having a specific gravity of 1.25. It can be cast in simple molds, and forms a hard, heat-resistant plastic. No water or other volatile products are released during the polymerization that might interfere with the preparation of dense, non-porous articles. Shrinkage during polymerization is substantially lower than that of other materials of the same type.

It has a refractive index of about 1.57, which is higher than most optical glass. The material can be made into a plastic that is water-clear or it can be produced in a wide range of colors —transparent, translucent, or opaque. It has high dielectric strength and electrical resistivity, and promises to find many valuable applications in the electrical field. Its resistance to abrasion is much higher than the thermoplastics, making possible its use in places where plastics heretofore have been unsuitable.

In its cast state, "Kriston" is odorless, tasteless, non-toxic, and dimensionally stable. After molding, it can be worked with standard machining and polishing equipment. 202

Improved Grease for Ball and Roller Bearing Motors

An improved grease for ball and roller bearing motors has been announced by the Westinghouse Electric Corporation, Pittsburgh 30, Pa., that provides dependable lubrication at temperatures ranging from 13 to 176 degrees F. for all speeds up to 3600 R.P.M. and for horizontal or vertical operation. The grease is stable, highly resistant to oxidation, and will remain in a bearing for an indefinite period without drying out, caking, or separating. It is supplied in a flexible tube designed for easy and economical use. 203

Flux for Aluminum Soldering, Brazing, or Gas Welding

Aluminum soldering, brazing, or gas welding can be accomplished with a new flux produced by the American Solder & Flux Co., Philadelphia, Pa. This flux, known as "Amco No. 4015," can be used with aluminum brazing rods to braze either rolled or cast aluminum; it can also be employed, in combination with the proper welding rods, to weld rolled or cast aluminum. In soldering operations, the flux can be used with the so-called "aluminum solders" or with the ordinary 50-50 tin-lead solder.

The compound has a relatively low melting point and retains its activity over a wide range of temperatures, thus being applicable to all

To obtain additional information on materials described on this page, see lower part of page 238.

three types of joining operations. It has high fluidity, is an excellent cleaning agent, and insures a good, strong joint. This flux can also be employed for soldering, brazing, or welding aluminum to iron or steel, and to brass, copper, Inconel, Monel, aluminum, bronze, and other alloys. 204

Synthetic Plastic Adhesive for Laminated Construction

For establishing strong, lasting laminations of metals, plastics, and woods in various combinations, a synthetic plastic adhesive known as "Cordo-Bond No. 250," has been brought out by the Cordo Chemical Corporation, 34 Smith St., Norwalk, Conn. This adhesive bonds quickly by baking at a glue-line temperature of 250 degrees F. under a pressure of 50 pounds per square inch. The resulting bonds show high resistance to water, mild acids and alkalies, oil, salt spray, and general weathering conditions. The shear strength of the bonds ranges up to 2000 pounds per square inch. Cordo-Bond No. 250 is suitable for light-weight, high-strength laminated construction and other mass production bonding of most materials in common use. 205

Special Low-Carbon Ferro-Manganese Announced by Electromet

The Electro Metallurgical Sales Corporation, Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y., has announced a new special low-carbon ferro-manganese. This special grade is produced in the maximum 0.10 per cent carbon grade. The following is a typical analysis: Manganese, 90 per cent minimum; phosphorus, 0.06 per cent; and carbon, 0.06 per cent. The high ratio of manganese to undesirable elements in this special low-carbon ferro-manganese makes it particularly useful for adding manganese to stainless steel and other steels where high purity is essential. 206

New Ceramic Material Has Unusual Dimensional Stability

A thermal expansion coefficient in the same range as that of Invar (a nickel-steel alloy long employed in the manufacture of precision instruments and standard measures) and high resistance to extreme thermal shock are outstanding properties of a ceramic material recently developed by the General Ceramics & Steatite Corporation, Keasbey, N. J. The new ceramic, designated "M-244," has been heated to a temperature of 1400 degrees F., and then immediately plunged into an ice-water bath without cracking, and retained its original dimensions at both temperature extremes within the limits characteristic of Invar.

Potential uses for the new ceramic include such applications as high-temperature furnace construction, insulation for high-precision instruments in which dimensional changes must be absolutely minimized, and many electrical and electronic purposes demanding a low thermal expansion coefficient in ceramic parts...207

Rust Inhibitors Developed for Inside Storage Protection

Two new types of specialized rust inhibitors for temporary protection of metal parts and materials during storage have been added to the line of the Carbozite Corporation, First National Bank Bldg., Pittsburgh 22, Pa., manufacturer of industrial coatings. Carbo "C" inhibitor, the more universal of the two, is inactive on all metals and alloys, including magnesium and aluminum. Carbo "N" inhibitor has no effect on iron, steel, or ferrous alloys, although it does have a slight action on softer metals, such as lead, zinc, magnesium, and aluminum.

Both of the new inhibitors prevent rust in lines through which salt solutions are drained from crude oil storage tanks and from the bottoms of tanks where water and brine solutions are used in the manufacture of ice. They are not suitable for protecting metal products in outside storage. These inhibitors can also be used as a mixture with cutting oils to protect threads from rust. 208

Hard-Facing Alloys for Electric Arc Application

Coated Stoody 1 and Coated Stoody 6 are two hard-facing alloys recently introduced on the market by the Stoody Co., Whittier, Calif. A special dipped coating makes application easy with either alternating- or direct-current arc-welding equipment, and at the same time, protects the alloying elements, so that the weld deposits have the desired physical properties.

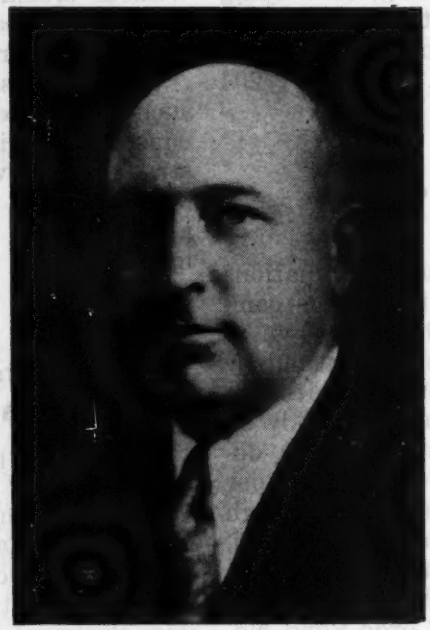
These two hard-facing electrodes are recommended for use on all heavy equipment subject to heat, abrasion, corrosion, and impact, and for intricate parts where oxy-acetylene hard-facing is impractical. Coated Stoody 1 is generally applied where sliding abrasion is a major factor. Coated Stoody 6 is preferable for those applications involving impact, because of its greater ductility. 209

To obtain additional information on materials described on this page, see lower part of page 238.

Convention of National Metal Trades Association

THE forty-sixth annual convention of the National Metal Trades Association was held at the Hotel Cleveland, Cleveland, Ohio, November 15 and 16. The convention opened with sessions on November 15, when such subjects as job and salary rating, employe rating, re-employment of veterans, labor negotiations, wage incentive methods, and conference leadership training were dealt with.

Among the important papers read before the Association should be mentioned "Sound Industrial Relations for Sound Industrial Progress," by Louis Ruthenburg, president of Servel, Inc., Evansville, Ind.; and "Are Your Foremen Cost-Conscious?" by George S. Dively, vice-president and general manager of Harris-Seybold-Potter Co., Cleveland.



H. H. Kerr, Newly Elected President of the National Metal Trades Association

E. S. Ward, assistant treasurer of the United Engineering & Foundry Co., Pittsburgh, Pa., spoke on the subject "How Do You Rate Your Office and Supervisory Employes?" "Industrial Relations" was the topic dealt with by Leonard P. Ayres, vice-president and well-known business analyst of the Cleveland Trust Co., Cleveland. Victor Short, head of the Institute of Human Science, Chicago, Ill., spoke on "Human Relations and the Foreman."

Other important addresses were made by George Romney, general manager of the Automobile Manufacturers Association, Detroit, Mich., whose subject was "Reconversion Brings American Industry to the Crossroads." O. L. Beardsley, director of the Personnel Department's service activities of the General Motors Corporation, Detroit, Mich., discussed "Unionization of Management." Abstracts of some of these papers will be published in the January number of MACHINERY.

The following officers were elected: President, H. H. Kerr, of the Boston Gear Works, Inc., North Quincy, Mass.; first vice-president, Howard Goodman, of the Goodman Mfg. Co., Chicago, Ill.; and second vice-president and treasurer, T. J. Morton, Jr., of the Hoosier Cardinal Corporation, Evansville, Ind.

Machine Tool Distributors Hold Annual Meeting

THE twenty-first annual meeting of the American Machine Tool Distributors' Association, held at the Hotel Statler, Cleveland, Ohio, Monday and Tuesday, November 19 and 20, was attended by an unusually large number of members. At the executive session on Monday morning, which was presided over by the president of the Association, A. B. Einig, of the Motch & Merryweather Machinery Co., Cleveland, reports were presented by the various officers and standing committees. In the afternoon of the same day, A. G. Bryant, president of the Bryant Machinery & Engineering Co., Chicago, Ill., presented a paper on "The Activities of Government Agencies," while R. L. Giebel, of Giebel, Inc., New York City, spoke on "Government Surplus Equipment," a topic of vital interest at the present time.

At the Tuesday morning session, George R. Ray, of the Marshall & Huschart Machinery Co., Chicago, presented an address on "Advertising Material Used by Members," and Tell Berna, general manager of the National Machine Tool Builders' Association, spoke on "The Machine Tool Industry from the Manufacturer's Viewpoint."

Tuesday afternoon an open forum was held devoted to discussions of current problems facing the machine tool distributing business.

The following officers were re-elected for the coming year: President, A. B. Einig, Motch & Merryweather Machinery Co., Cleveland, Ohio; vice-president, George Habicht, Jr., Marshall & Huschart Machinery Co., Chicago, Ill.; second vice-president, D. N. Macconel, Machinery Sales Co., Los Angeles, Calif.; and secretary-treasurer, C. C. Brogan, W. E. Shipley Machinery Co., Philadelphia, Pa.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Harvill Automatic Hydraulic Die-Casting Machine

The third of four new machines comprising the line of "package plan" die-casting equipment developed by the H. L. Harvill Mfg. Co., P. O. Box 335-P, Vernon, Calif., has just been announced. This HDO series die-casting machine has been developed for the high-pressure casting of aluminum, magnesium, and zinc alloys. It is now available in three models of the same basic design with a normal vertical die dimension of 13 inches for the smallest size up to 21 inches for the largest machine. The normal horizontal die dimension varies from 20 inches in the HD-101 to 31 inches in the HD-301 model. The horizontal die space may be increased, however, by extending the dies beyond the machine platen and providing an auxiliary support, if the lay-out of the cavities in the die is such as to permit the proper flow of metal. The die thickness varies from 18 1/2 inches for the HD-101 to 28 1/2 inches for the HD-301 machine, with the dimension between the die faces in the open position ranging from 10 inches to 11 1/2 inches.

For casting aluminum alloys, the metal capacity of the HD-101 machine is 1.7 pounds to 6.37 pounds; that of the HD-201 machine, 2.2 to 9.2 pounds; and that of the HD-301 machine, from 2.6 to 11.6 pounds. When a small-diameter piston is used, the metal injection pressures are 6600 pounds per square inch for the HD-101 machine, 9900 pounds per square inch for the HD-201 machine, and 11,000 pounds per square inch for the HD-301 machine. When large pistons are used to attain the maximum volume of injected metal, the pressures exerted on the metal in the die cavities are 3220 pounds per square inch for the HD-101 machine, and 3400 pounds per square inch for both the HD-201 and the HD-301 machines.

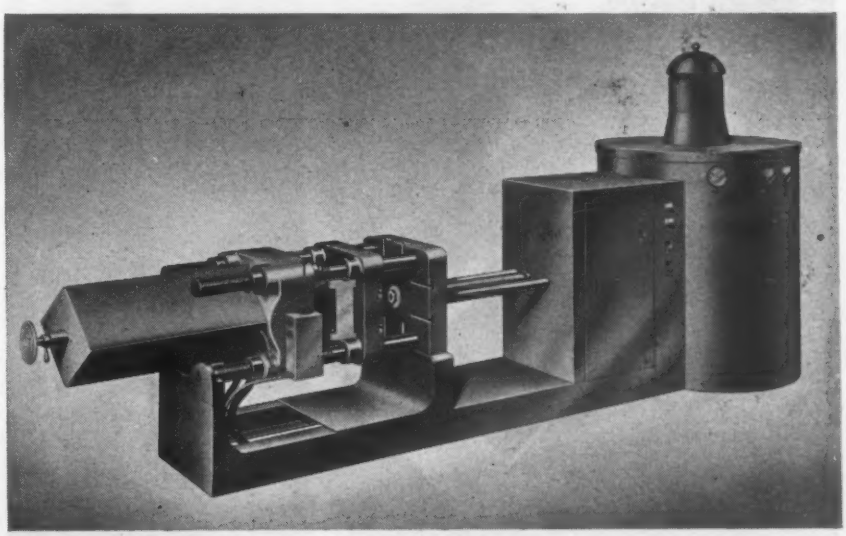
The HDO series machines are equipped with electric timers and limit switches for fully automatic control, but can be switched to semi-automatic or manual control at the option of the operator. The use of water throughout the hydraulic system serves to eliminate fire hazard. The special hydraulic system can be varied by the operator from 200 to 1000 pounds pressure input to the cylinder, with pressure on the locking cylinder automatically increased to compensate for the increased pressure at which the metal is "shot" into the die.

The die-locking method is positive, and is not subjected to spring between the die faces, because of the compressible characteristics of fluids. An automatic continuous metal-feeding device has been developed for use with the HDO cold-chamber machines in order to convert the equipment for automatic operation in the production of zinc and aluminum castings. This equipment, known as the HDZC conversion unit, can be attached to the HDO machine beneath the cold-chamber injection assembly and can be installed in less than two hours. Utilization of this conversion unit replaces two conventional machines, permitting use of one cold-chamber machine in place of a cold-chamber machine and a hot-chamber machine, or machine of the gooseneck type.

71

Mounted Formed Abrasive Points

The Abrasive Co., Tacony and Fraley Sts., Philadelphia 37, Pa., is now offering to the trade a complete line of mounted abrasive-point utility kits for job shops and tool-rooms. Utility kit MP21 contains twenty mounted wheels and points and an Electrolon dressing stick, 5 by 5 inches by 1/2 inch, for dressing points and for changing point shapes for special applications. Utility kit MP9 contains nine mounted wheels, and



Harvill Automatic Hydraulically Operated Machine for High-pressure Die-casting of Aluminum, Magnesium, and Zinc Alloys

To obtain additional information on equipment described on this page, see lower part of page 238.

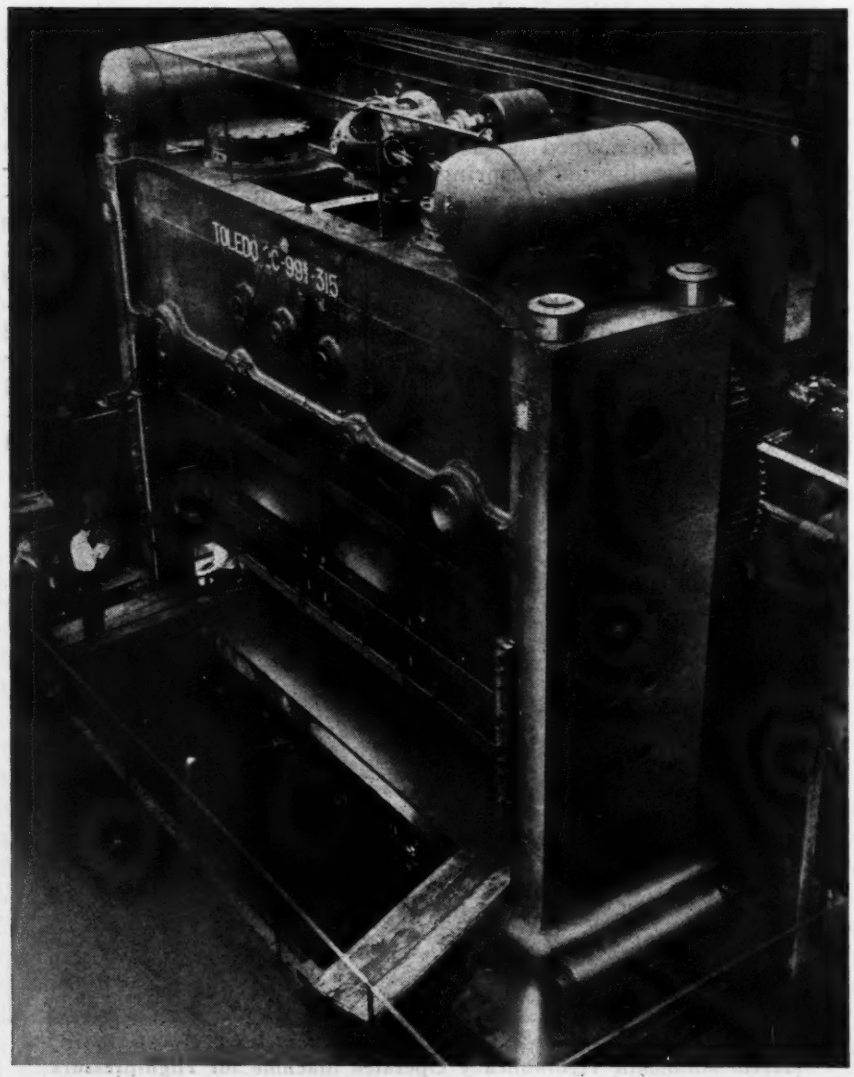
kits MP7A and MP7B each contain seven points. The MP7A kit has smaller type points adapted for jobs requiring finer work or for use in inaccessible spots. These wheels and points are all mounted on stainless-steel mandrels, 1 1/2 inches long by 1/8 inch in diameter.—72

Giant Bliss-Toledo Rail Press Built for Automotive Industry

A single-action straight-sided rail press weighing 1,250,000 pounds, which is said to be one of the largest ever built, has just been completed by the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn 32, N. Y., and is to be shipped to Russia for use in that country's automotive industry. This machine is designated the "No. 2-C-99 3/4, 315-inch Bliss-Toledo." It is estimated that fifteen freight cars, including special equipment, will be necessary to transport this huge press after it is disassembled and boxed. Two automotive chassis frames can be blanked every ten seconds on this press, operating at a rate of six strokes per minute. Actual production, however, is determined by the speed with which the work can be removed from the press and replaced by a new blank.

The bed measurements of this press are 80 inches front to back by 315 inches left to right. It will accommodate two sets of dies for making rails for trucks, tractors, automobiles, or box-car ends and main beams for freight cars. There are two crankshafts running from the front to the back of the machine, which is of the four-piece steel tie-rod construction. It is triple-geared in the ratio of about 53 to 1, and has a pressure capacity of 2500 tons at the bottom of the working stroke. A multiple-disk air-operated friction clutch with electric push-button control and an air-operated flywheel brake are features of the press. The slide has a stroke of 16 inches, and is provided with an air-operated counterbalance. The slide adjustment of 8 inches is obtained by a reversible motor. The die space from top of bed to bottom of slide is 43 inches with the ram down and the adjustment up.

Cushioning of the bed is taken care of by five hydro-pneumatic cushions, each having a capacity of 500 tons at a hydraulic pressure of 525 pounds per square inch. The motor equipment consists of a 200-H.P., 1000-R.P.M. main-drive motor and a 30-H.P. 1500 R.P.M. elevating motor.—73



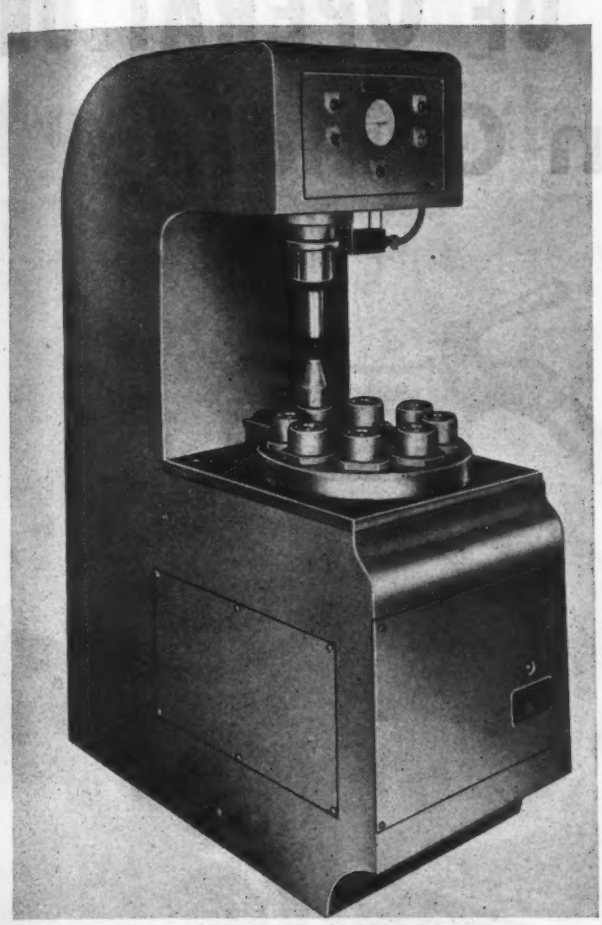
Giant Press Built by E. W. Bliss Co. for Use in Russia's Automotive Industry

Copper "Cushioned" Tool Bits

High-speed steel tool bits of 12 per cent cobalt content having a copper cushion 1/32 inch thick brazed to their bottom surfaces have been developed by the General Tool & Die Co., Inc., 555 Prospect St., East Orange, N. J., for general-purpose work. The copper cushion acts as a shock absorber and enables the bit to be used on tough "jump-cut" work without damaging the cutting edge. The copper cushion also minimizes shifting of the bit in its holder. At the same time, tool breakage is decreased because less clamping pressure is required.

The copper cushion, being softer than the steel in the holder, prevents damage to the latter member. On the other hand, if the copper cushion is scarred by the holder, it is an indication that the holder has been damaged. The cushion feature permits bits of greater hardness to be used, the hardness of the cushioned tool bits ranging from 65 to 68 Rockwell C. The increased speeds and feeds possible with the new bits are said to result in an increase in the metal removal capacity of 25 to 50 per cent. These cushion bits are available in nine sizes, ranging from 1/4 by 1/4 by 2 1/2 inches to 1 by 1 by 7 inches.—74

To obtain additional information on equipment described on this page, see lower part of page 238.



Dial-feed Automatic Work-ejecting Press Placed on the Market by Hydraulic Machinery, Inc.

"Curved Clearance" Reamer and Cutter Grinder Brought out by Joshua Hendy Iron Works

"Hy-Mac" Press with Continuous Dial Feed and Automatic Work Ejector

A press which is driven by a "Hy-Mac" hydraulic unit housed in the base and is equipped for continuous dial feed and automatic ejection of the work has been placed on the market by Hydraulic Machinery, Inc., 12825 Ford Road, Dearborn, Mich. Operation consists of feeding the part manually to the machine and pressing the cycle-starting button. The part is then indexed automatically to the work station. Next the ram moves down and performs the required operation at the work station; at the same time, the ejector ram moves up at the unloading station and ejects the part into the chute or conveyor. The work ram and the ejector ram then return to their starting positions, thus completing the cycle. If set for single-cycle operation, the machine will stop at this point, but it may be set at "repeat cycle" for continuous operation.

The operating cycle of the machine is controlled by hydraulic sequence valves, solenoid-operated four-way valves, pressure switch, limit switch, and a special electrical control panel. The crown of the machine houses the push-button panel, pressure gage, and work ram, while the base accommodates the dial-feed indexing mechanism operated by a swivel type cylinder; the locating cylinder which positively locates and locks the dial-feed mechanism; and the ram which ejects the finished part. ——75

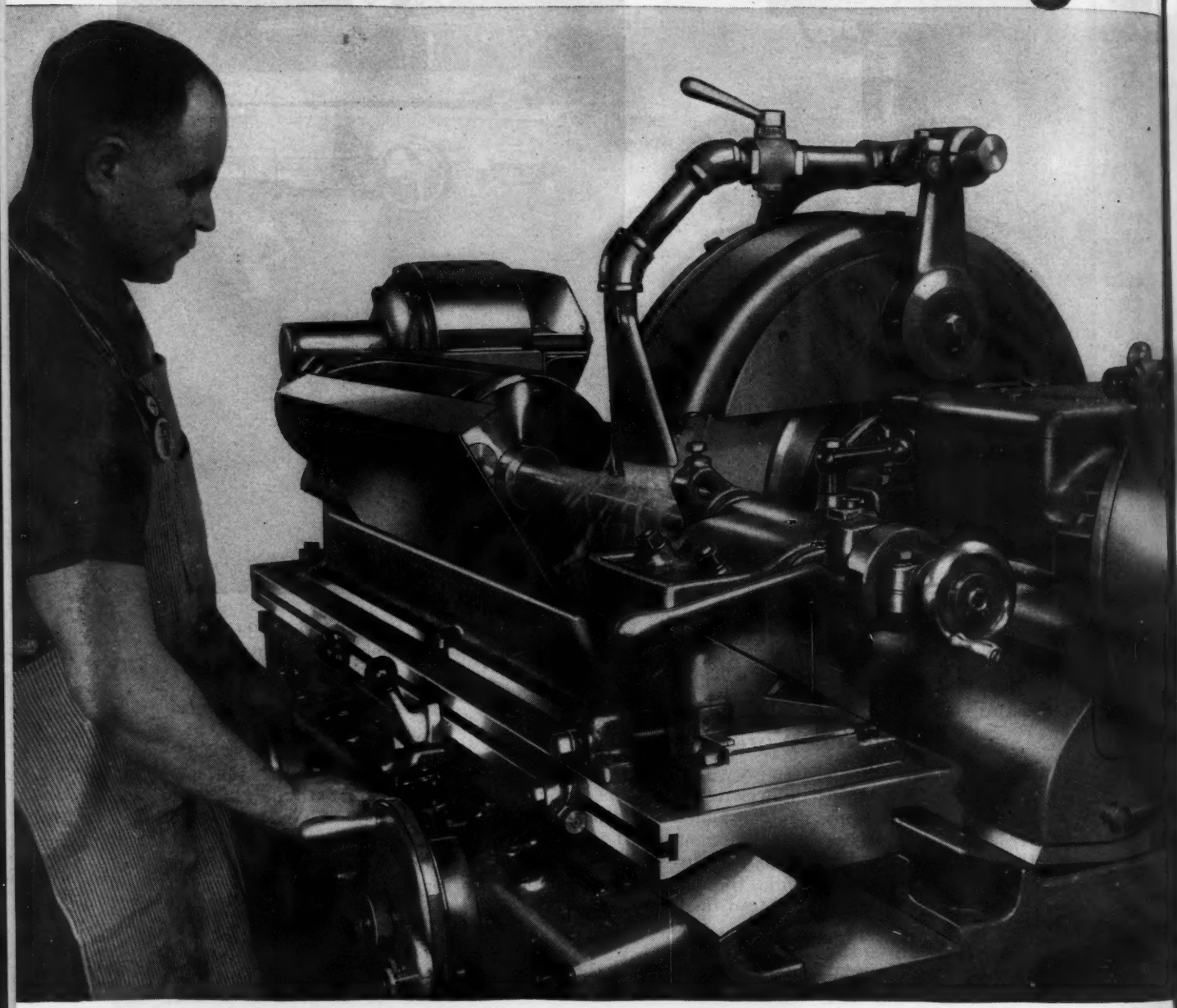
"Curved Clearance" Reamer and Cutter Grinder

A reamer and cutter grinder designed to produce a "curved clearance," which provides maximum support directly behind the cutting edges of taper reamers and other types of cutting tools, has been brought out by Joshua Hendy Iron Works, Sunnyvale, Calif. The "Standard" model of this new Hendy-Larsson reamer and cutter grinder, shown in the accompanying illustration, is equipped with a 30-inch sine bar which enables taper reamers to be ground within limits of 0.0001 inch. A "Junior" model attachment with a 20-inch sine bar, which will fit any standard cutter grinder, also makes it possible to adapt machines previously installed for "curved clearance" grinding of reamers and cutters.

Three dials for obtaining accurate adjustment of the cutter grinding wheel with respect to the tool or cutter to be ground eliminate the necessity for checking clearance and serve to reduce set-up time to a minimum. By using these adjusting dials, the operator sets the machine for the proper cutter diameter, adjusts the clearance slide, and dresses the cutter wheel. After these adjustments, the reamer or cutter blades can be ground with the desired clearance. A carbide-tipped locating finger synchronized with the dresser prevents any chance of error. This finger moves automatically with the abrasive wheel as the latter becomes worn. Clearances once established can always be duplicated. ——76

To obtain additional information on equipment described on this page, see lower part of page 238.

20 SERIES' EASE OF OPERATION
Saves Time in Grinding

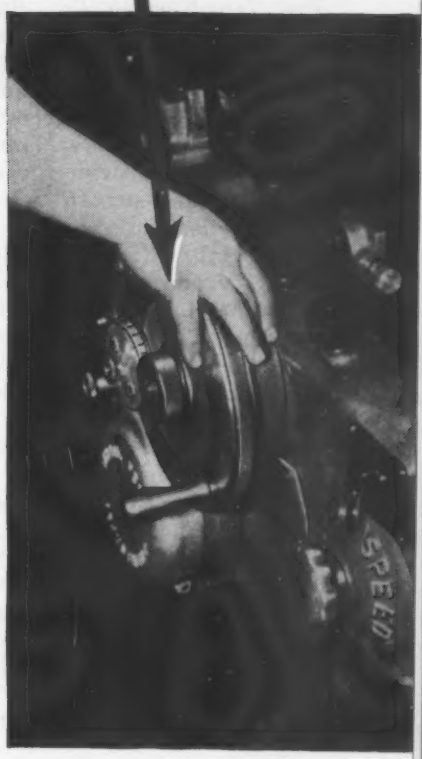


ELECTRICALLY CONTROLLED PLAIN GRINDING MACHINES
— for fine micro-inch readings with repeat accuracy on larger cylindrical work

No. 20	No. 22	No. 23
10" x 18"	10" x 36"	10" x 48"

BROWN &

Slight movement of One handwheel Controls Semi-Automatic Cycle



Advances wheel to work

Starts headstock, table and coolant

— *and* on completion of grinding

Withdraws wheel

Stops headstock, table and coolant

Manual Knob Control — also employing the full advantages of Electrical Control — is available at the turn of a switch when the Semi-Automatic Cycle is not desired.

Either **Traversing** or **Straight-in-Feed** production grinding . . . full range of headstock speeds, table movements and cross feeds give great flexibility.

Simple controls – grouped at operating position – headstock and table speeds, table dwell, etc., selected by turning switches or rheostats.

Let us show you the production possibilities of these machines on *precision* grinding of larger cylindrical work.

BROWN & SHARPE MFG. CO.
Providence 1, R. I., U. S. A.

SHARPE

Van Norman Horizontal Milling Machine

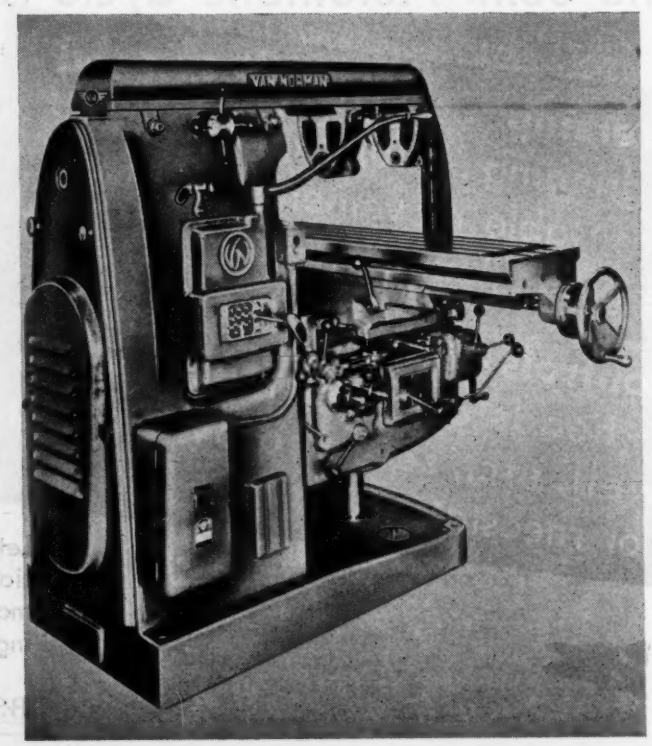
The Van Norman Co., Springfield 7, Mass., has developed a No. 3 heavy-duty horizontal milling machine designed to handle a wide range of general-purpose and production milling work. This machine is built to provide the rigidity required for smooth operation on the heaviest cuts, and to combine strength with a high degree of accuracy and exceptionally sensitive control. Smooth, uniform application of power to the cutter is assured by a heavy flywheel mounted on the spindle. New design features include a broader and heavier column and base, with internal ribbing which provides rigid support for the spindle transmission and the knee.

The over-arm can be easily positioned by a pilot wheel. Sturdy arbor supports for B style arbors are clamped to the under side of the over-arm by cam type locks. These supports are equipped with oil reservoirs which simplify arbor lubrication.

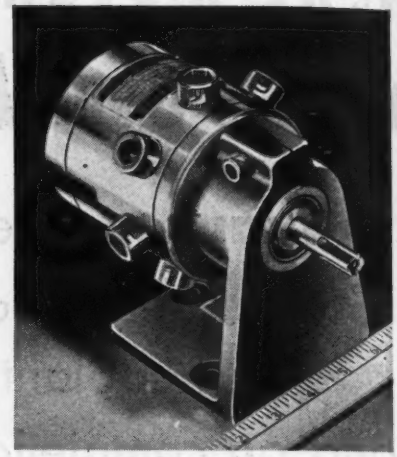
The new heavy-duty cutter-spindle and transmission have wide-face, hardened alloy-steel gears, mounted on multi-spline shafts which rotate on taper roller bearings. Operation is facilitated by the front and rear controls of all power feeds, which are arranged for actuation in the direction of the desired movement. This feature also provides maximum safety for the operator. In addition, hand feeds are provided at both front and rear of the machine, which enables the operator to line up the work from either position. The single-lever speed and feed selectors provide quick selection of the eighteen speeds and feeds.

Other important features include conveniently located spindle control lever, which can be easily positioned for front or rear operation; automatic lubrication to all moving parts; large-diameter feed-screw; large dial graduated to 0.001 inch.

The standard milling machine table is 64 by 14 inches; the drive motor, 7 1/2 H.P.; longitudinal travel, 34 inches; saddle cross-feed, 12 inches; and vertical knee feed, 17 inches. Eighteen speeds are available ranging from 25 to 1250 R.P.M. and there are eighteen feeds from 3/8 inch to 32 inches per minute. The machine is available with either a plain or a universal saddle. The universal saddle permits the table to be swiveled 45 degrees to the right and 45 degrees to the left. ——— 77



Heavy-duty Production and General-purpose Milling Machine Developed by the Van Norman Co.



Seco Radial Pump for Hydraulic Systems

Seco Fluid Power Pumps for Hydraulic Systems

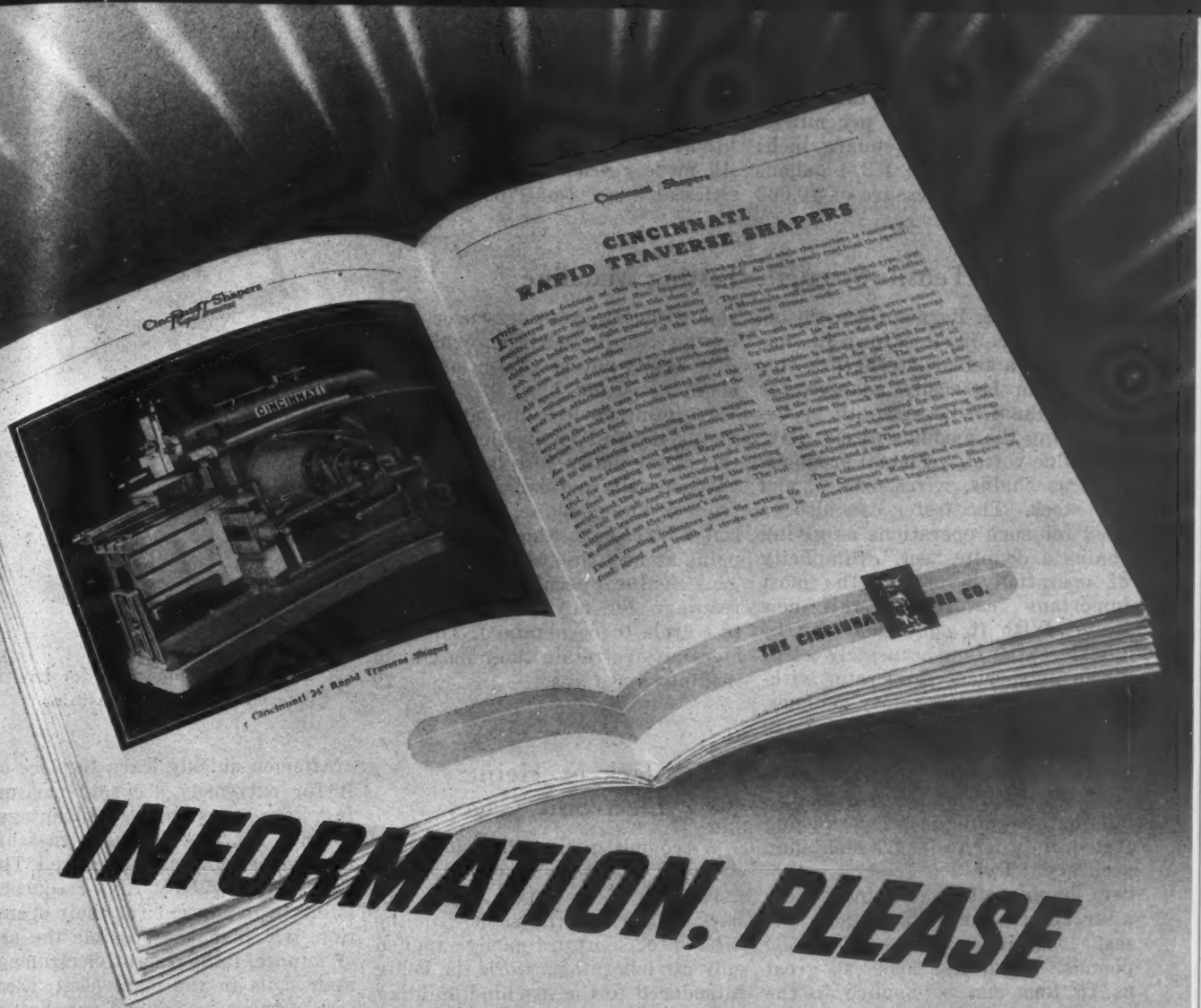
A line of Seco radial hydraulic pumps built to generate pressures up to 10,000 pounds per square inch and to stand up under continuous operation has been developed by the Simplex Engineering Co., Zanesville 18, Ohio. These pumps are designed for application to hydraulic machines and equipment using oil for the operating medium. Each of the seven radial cylinder sleeves of one of these new pumps is fitted with a cam-actuated hollow tool-steel piston. Each piston is heat-treated to combine a hardness of 60 Rockwell C with high strength, elasticity, and good wearing qualities.

The hollow design of the piston permits it to expand as the pressure builds up, and thus increases the sealing power between the moving piston and the cylinder walls of the pump body. Leakage is thus prevented. When the pressure is released, all members of the pump return to their original dimensions.

Motion is transmitted to the seven pistons by an eccentric cam, the camshaft being supported by two needle roller bearings. The flanged foot of the piston bears on a third needle roller bearing which floats on the eccentric cam. The intake characteristics of these Seco radial hydraulic pumps are similar to those of centrifugal pumps. They are not self-priming, and to insure the best results, they should be installed below the oil reservoir supply, where they will be kept primed by gravity. After being primed, they will maintain a vacuum of 25 inches of mercury, provided the intake line is air-tight.

These pumps are now available in four models. The No. 20 LAH pump, (illustrated), delivers 1/2 gallon per minute at 10,000 pounds

To obtain additional information on equipment described on this page, see lower part of page 238.



INFORMATION, PLEASE

Today, as ever, Cincinnati Shapers are indispensable in both the large plant and the small shop. Such Cincinnati features as built-in power rapid traverse to the table, multiple cam feeds, direct reading indicators bring to the user of a single machine or of many machines an outstanding usefulness.

Write for informative book N-3 on the complete line of Cincinnati Shapers.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

per square inch; the 20 LAL pump delivers 1 1/4 gallons per minute at 3000 pounds per square inch; the 80 LAH delivers 1 3/4 gallons per minute at a pressure of 10,000 pounds per square inch; and the 80 LAL delivers 5 gallons per minute at 3000 pounds per square inch. All models reach their rated capacities at a speed of 1750 R.P.M.—78

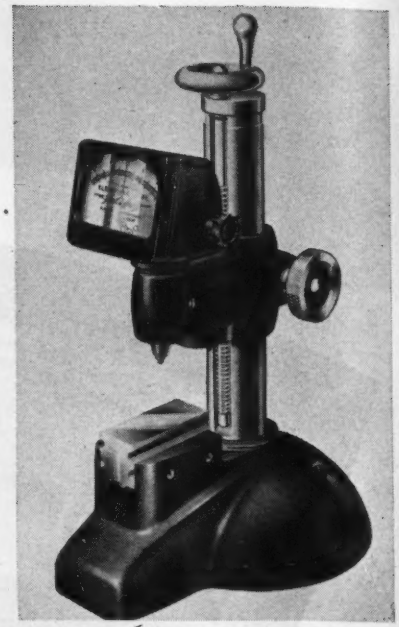
Tensile-Strength Testing Machine

The John S. Barnes Corporation, 325 S. Water St., Rockford, Ill., has developed a tensile-strength tester which can be easily adapted for testing the tensile strength or determining the modulus of elasticity of a wide variety of metal products, such as chains, wires, cables, and bar stock. The tester can also be used for such operations as giving chains a definite "set." Simplicity of operation is one of the most important features of this new tester. With it, equipment can be quickly, safely, and accurately tested by an inexperienced operator without resorting to laboratory methods.

The tester is 25 feet long and will accommodate chains and cables of any length up to 20 feet. Easily adjusted platforms are provided to eliminate sagging of the work being tested, in order to insure maximum accuracy. Two low-friction cylinders, having a bore of 4 inches and a stroke of 8 inches, provide initial test load pressures up to 1500 pounds. Final test loads as great as 15 tons can be applied to the work.

One chain or cable can be placed under test while another is being prepared. The operator is protected from injury through chain breakage by a safety cover. The illustration shows the front safety cover down in the testing position, while the rear safety cover is open, or in the loading position.

A timing device automatically removes the test load. Elongation of the metal under test is registered automatically on verniers at the front of the machine. The verniers can be reset to the zero reading point at any time during the test. This feature permits comparative readings for any portions of the test cycle to be obtained. The verniers always retain their maximum readings until reset. ——79



Electronic Comparator for External Precision Measuring

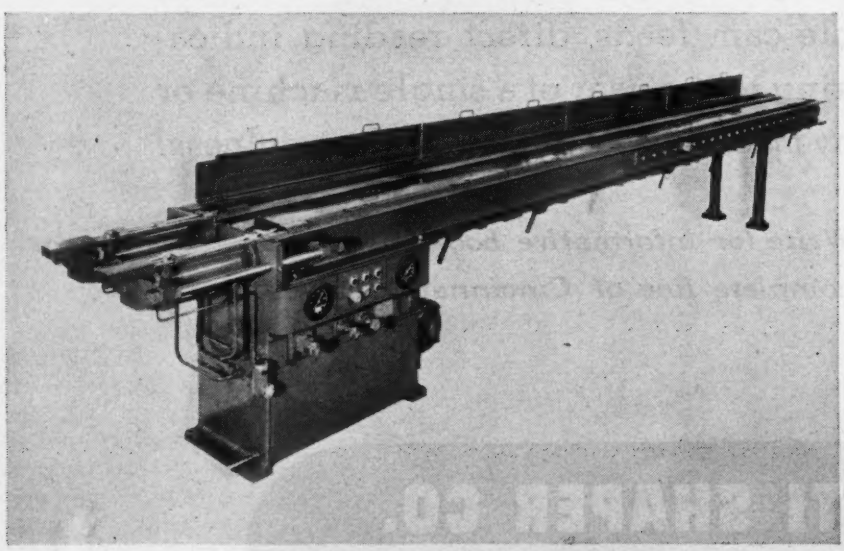
Jack & Heintz Electronic Gages

A complete line of electronic gages or comparators, designed for gaging a wide variety of mass production work in the shop with the high precision ordinarily applied only to laboratory work, is being introduced to the machine building industry by Jack & Heintz, Inc., Electronic Division, Cleveland 1, Ohio. The consistent accuracy of this electronic measuring equipment when used by inexperienced workmen, and the dependence that skilled craftsmen quickly learn to place on it for extremely accurate measuring, are outstanding advantages claimed for the electronic measuring gages of this new line. The gages employ only high-frequency alternating current for their operation, which makes possible the use of minute, light-weight electromagnetic coils in the gage head Electronic tubes provide a convenient and economical means of generating and amplifying the small amounts of high-frequency current required.

Other advantages claimed for these gages include small-size gaging head, which enables work to be measured in confined areas; no errors due to temperature changes, as the heat loss in the gaging head is negligible; no warming-up errors, because the heat producing units of the system are all located in the power unit, which is separate from the actual gaging fixtures; and correctly balanced design, which makes the accuracy of the electronic system independent of ordinary line voltage fluctuations.

The electronic gaging principle employed in this line of external and internal gages is adaptable to many special fixtures for precision production inspection, gaging parts for selective assembly, and other special applications requiring measuring instruments having graduations ranging from 0.0001 to 0.00001 inch or even 0.000005 inch.

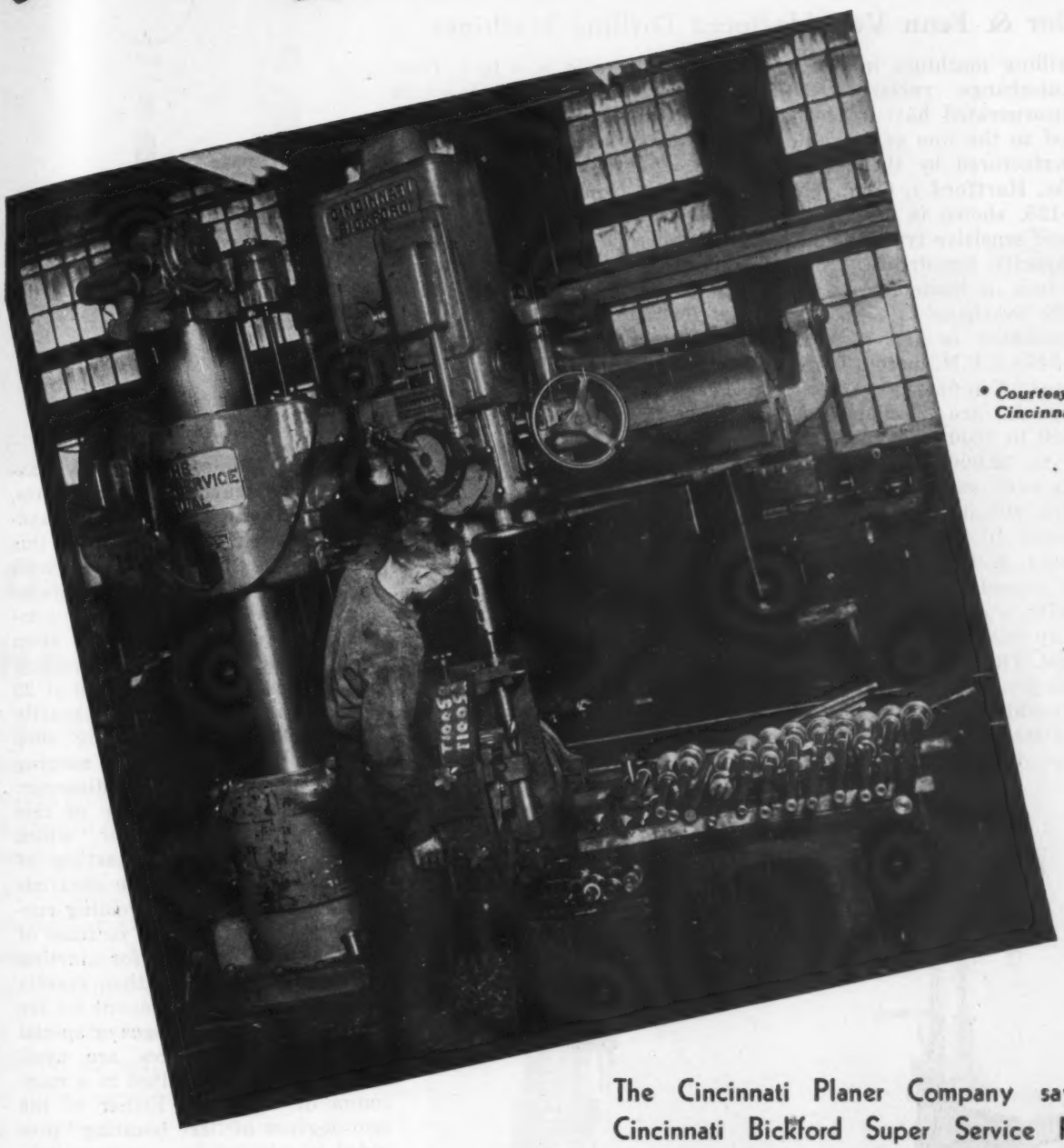
The Model AC electronic comparator of this line, shown in the



Tensile-strength Testing Machine Developed by the John S. Barnes Corporation

To obtain additional information on equipment described on this page, see lower part of page 238.

IT'S ECONOMICAL...



* Courtesy of Cincinnati Planer Co.

The Cincinnati Planer Company says that this Cincinnati Bickford Super Service Radial Drill, working on Feed and Rapid Traverse Boxes, has brought accuracy, speed, ease of handling and economical performance to the job.

Working to a .001 tolerance on hole diameters, and .001 center to center distances, Bickford performances lowered costs and made the job easier.

Write for detailed Bulletin R-24A.

Equal Efficiency of Every Unit Makes the Balanced Machine

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

See our condensed catalog in Sweet's File

THE CINCINNATI BICKFORD TOOL CO. **Cincinnati 9, Ohio U.S.A.**

accompanying illustration, is intended especially for precise external measuring.

The gaging head of the electronic indicator can be quickly and easily removed from the comparator stand for use with other fixtures. It is also used as a separate indicator, the gaging head being independent of the comparator stand. ——80

Taylor & Fenn Variable-Speed Drilling Machines

Two drilling machines in which an instant-change variable-speed unit is incorporated have recently been added to the line of machine tools manufactured by the Taylor & Fenn Co., Hartford 1, Conn. The Model M-125, shown in Fig. 1, is a high-speed sensitive type machine with a capacity for drilling holes up to 3/8 inch in diameter in steel. The spindle overhang is 8 inches, and the machine is driven by a 1/2-H.P., 3450-R.P.M. motor. Three combinations of infinitely variable spindle speeds are available as follows: 500 to 2600; 900 to 4600; and 2400 to 12,000 R.P.M. The machine is built with from one to six spindles, the distance between spindles being 10 inches.

The Model M-96, illustrated in Fig. 2, is a medium-duty drilling machine with a capacity for drilling holes up to 3/4 inch in diameter in steel. The spindle overhang on this machine is 8 5/8 inches, and the machine is driven by a 3/4-H.P., 1800-R.P.M. motor. Any range of spindle speeds can be furnished in the ratio of 4 to 1, from 250 to 3500 R.P.M. This machine can also be furnished with from one to six spindles.

Handy reference charts are mounted in front of the spindles on both machines for selecting the correct speeds. The exact speed for drilling any given material is obtained by moving the dial setting to conform to the chart. Longer tool life and higher efficiency are obtained by using the speed shown. All bearings are of the sealed, self-lubricating, precision type. ——81

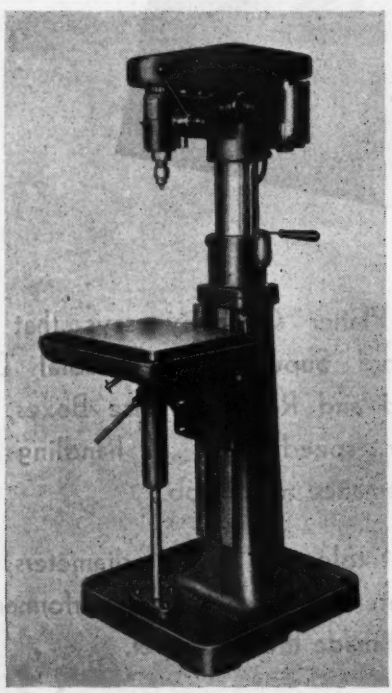


Fig. 1. Taylor & Fenn High-speed, Sensitive Drilling Machine

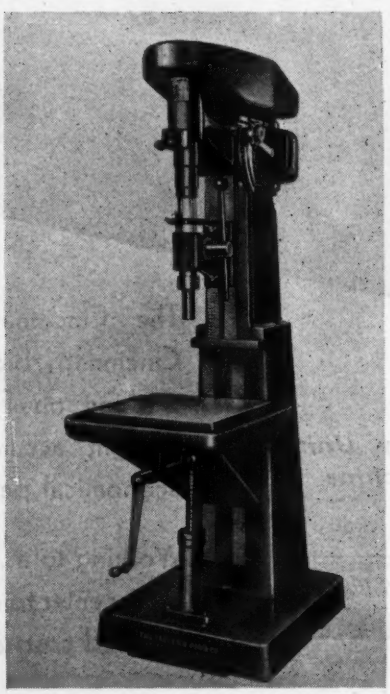


Fig. 2. Medium-duty, Variable-speed Drilling Machine Made by Taylor & Fenn

"Fleet Arc Jr." Welder with Quick Starting "Arc Booster"

Lincoln "Fleet Arc Jr." Welder

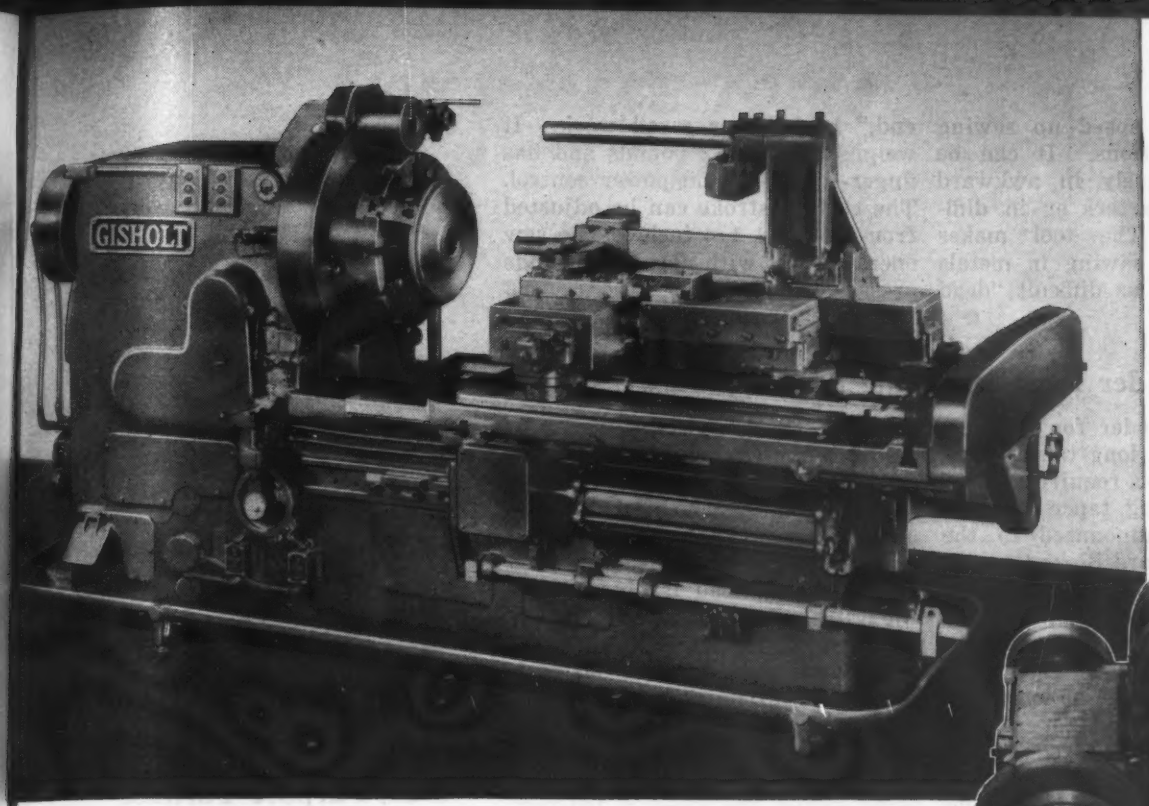
A low-priced welder designed for operation on rural power lines has just been announced by the Lincoln Electric Co., Cleveland 1, Ohio. This "Fleet Arc Jr." welder is built for operation on 230-volt, single-phase power lines, its high efficiency and high power factor meeting the limited input requirements of rural utility companies. It has a maximum input current of 35 amperes, and meets the new NEMA standards for welding machines of this type. The welder can be used with the standard 3-KVA power transformer provided by the power company. The current range is from 20 amperes at 20 volts to a welding duty current of 180 amperes at 25 volts. This gives sufficient capacity for handling most welding shop jobs. It uses electrodes ranging from 1/16 to 5/32 inch in diameter.

An outstanding feature of this welder is the "Arc Booster," which provides quick, easy starting of the arc. The instant the electrode touches the work, the welding current is given a boost or increase of considerable intensity for starting the arc. The current then reverts automatically to the amount set for the job. No high voltages or special high-frequency devices are used, the output being limited to a maximum of 52 volts. Either of the two degrees of "arc boosting" provided is selected by a snap switch, one for general work and the other somewhat lower amount for thin material such as automobile fenders. The welder weighs only 360 pounds, and can be readily transported about the shop. ——82

Air-Speed Pneumatic Saw

A saw and filing tool driven by compressed air has been developed by the Air-Speed Tool Co., 1028 W. Slauson Ave., Los Angeles 44, Calif. This tool has been designed

To obtain additional information on equipment described on this page, see lower part of page 238.



YOU CAN *"STRETCH"* THE SIMPLIMATIC, TOO!

Yes, one of the most interesting facts about the Simplimatic is its remarkable adaptability. With the simple basic design which provides freedom from the usual restrictions, it permits the use of a greater number of tool slides, each favorably placed, each favorably cammed for its own particular cut. Thus, the machine may be individualized to solve a variety of problems. And, in each case, you enjoy the high speed production and lower costs of an automatic machine designed specifically for the job.

A typical example of this is shown at right. Here, on an extended bed, one simple cammed tool slide moves six tools through a blended turning cut on a long cylindrical piece. Two other slides face the ends. Cammed rollers behind the six tool holders move the tools transversely. A sliding pneumatic tailstock facilitates mounting the piece.

The simple adaptability of this rugged, high speed automatic lathe may solve your problems as it has hundreds of others. Ask for all the facts about the Gisholt Simplimatic.

GISHOLT MACHINE COMPANY
1209 *E. Washington Ave., Madison 3, Wis.*

GISHOLT

Look Ahead . . . Keep Ahead . . .
With Gisholt Improvements in Metal Turning

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

to simplify and speed up sawing and filing operations. It can be used advantageously in awkward and cramped quarters or in difficult positions. The tool makes possible circular sawing in metals or wood, as well as difficult "dead end," keyhole, or scroll work. It weighs only 3 1/2 pounds and has finger-tip speed and power control. The cutting stroke can be adjusted from 1/4 to 1 1/4 inches. The saw operates best with about 85 pounds pressure at the tool. ——83

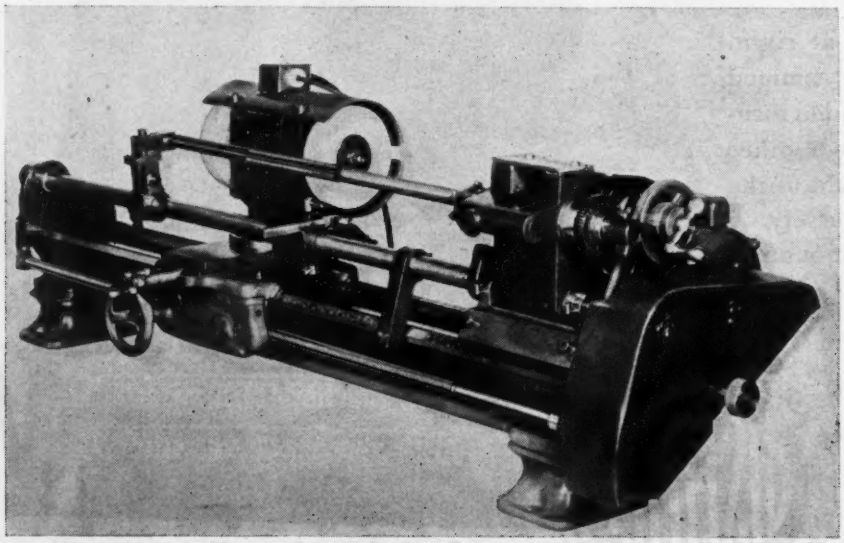
Grinder for Sharpening Staybolt Taps

A new tap grinder for sharpening staybolt taps, long taper reamers, and other tools requiring relief grinding over long taper surfaces has just been announced to the trade by the Edward Blake Co., 634 Commonwealth Ave., Newton Centre 59, Mass. This Model No. 4 machine is especially designed for feeding the side of a small grinding wheel along the taper of long taps to eliminate the need for a wide wheel such as would be required to cover the entire taper in one pass.

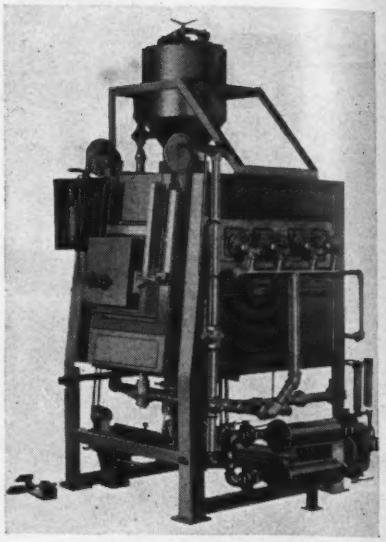
The standard wheel-head and work-head from the regular Blake Models Nos. 1 and 2 tap grinders are used on this machine. The work-head is mounted on a lathe bed, and the wheel-head is mounted on the lathe carriage cross-slide. The controls on the cross-slide provide longitudinal and cross-feed motions for the wheel-head.

Staybolt taps and long taper reamers are held on ball centers. The tailstock center can be moved off center any desired amount, so that the flutes will remain parallel to the grinding wheel. Any relief can be obtained by a simple setting, and any right- or left-hand tap up to 43 inches in length with two, three, four, five, six, eight, or ten flutes can be sharpened. A separate motor mounted behind the work-head revolves the work through a train of gears. The gears can be easily disengaged to permit hand operation. Power longitudinal feed for the wheel-head is obtained by engaging the lead-screw on the carriage.

The locating device properly positions the tap flutes for grinding. A wheel-truing device is also provided which can be located at any position along the pivot bar. After being locked, the wheel is fed past the diamond for truing. By simply equipping the machine with standard Blake bushings, any taps in the range covered by the standard Nos. 1 and 2 grinders can be sharpened on the chamfer. Thus, this special machine can be used for standard work at any time. It can also be used for grinding countersinks, the lead on reamers, three- and four-flute regular drills, step drills, and many other tools requiring relief on the point. The No. 4 machine is regularly supplied with two 110-volt, 60-cycle, single-phase, alternating-current motors, and two 80-grit grinding wheels, 6 inches in diameter, having face widths of 3/4 inch. ——84



Staybolt Tap Sharpening Machine Brought out by the Edward Blake Co.



Dual-purpose Furnace Built by Surface Combustion Corporation

Dual-Purpose Furnace

A new atmosphere-type muffle furnace developed to obtain maximum flexibility in handling different batch heat-treating operations is being offered to the trade by the Surface Combustion Corporation, Toledo 1, Ohio. This furnace is designed to produce the proper atmosphere for gas carburizing and yet to be applicable for general heat-treating. It can be quickly converted from a carburizing to a heat-treating atmosphere without shutting down. A twin filter unit is supplied, which makes it possible to clean one of the filters while the other is in operation. In tests extending over some months, the furnace has been kept in continual operation for hardening work during the day and for carburizing operations during the night shift.

The furnace is available in three sizes for light or medium batch operations. The inside dimensions of the smallest furnace are: Height, 7 inches; width, 12 inches; and length, 22 inches. This furnace has a capacity for heating 55 pounds of steel to a temperature of 1700 degrees F. per hour. The largest of the three furnaces has inside dimensions of 12 by 22 by 36 inches, and has a capacity for heating 170 pounds of steel to a temperature of 1700 degrees F. per hour.

A double door facilitates handling pieces of various sizes with a minimum loss of atmosphere. Both inner and outer doors are of the air lift type operated by a tilting treadle with manual selector. ——85

To obtain additional information on equipment described on this page, see lower part of page 238.

DON'T MAKE TOOLS WALK TO WORK...

GIVE 'EM A RIDE!

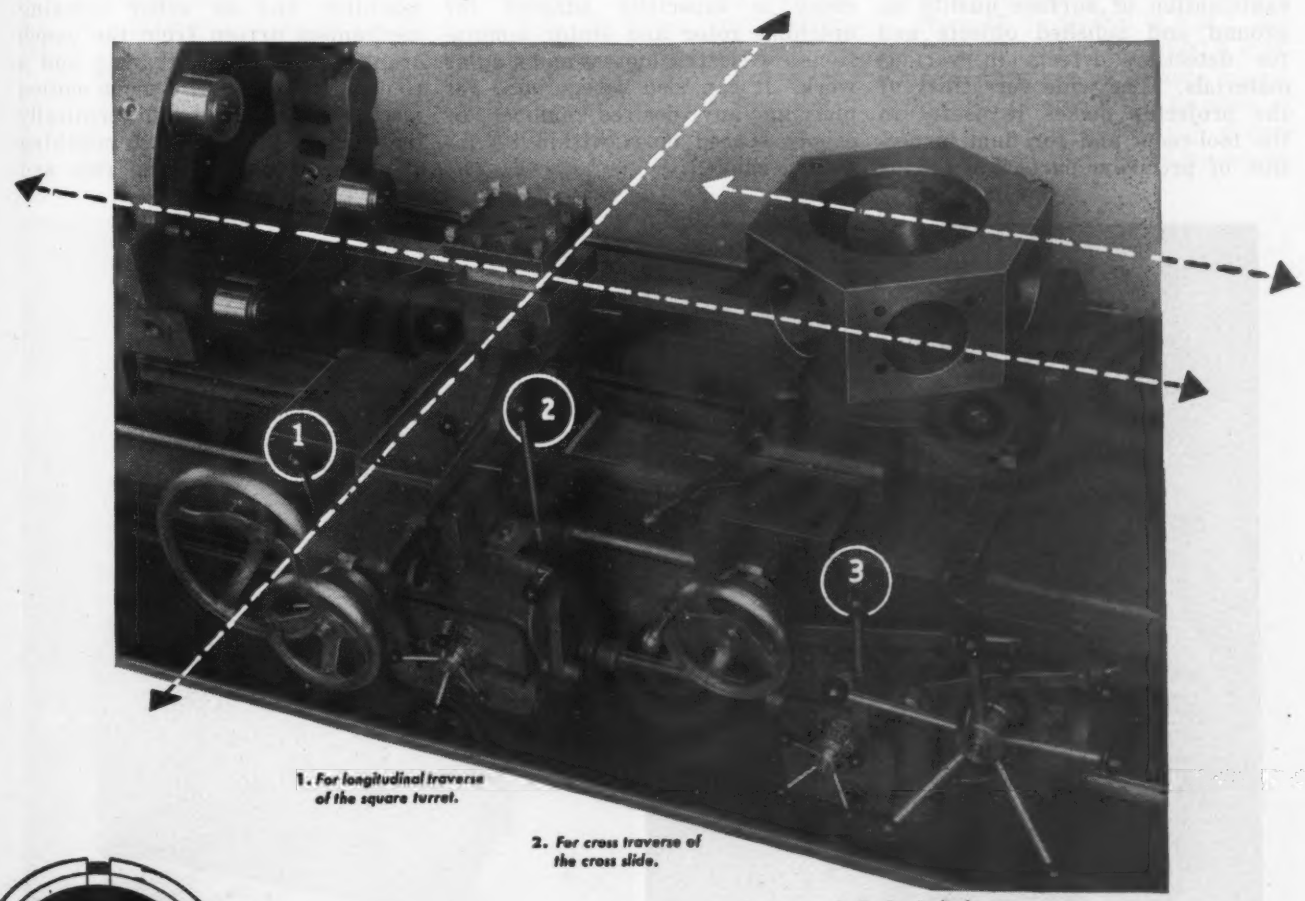
GISHOLT Standard—COMPLETE *Power Rapid Traverse* for ALL Saddle Type Turret Lathes

Here's another good reason why work goes faster on *all* sizes of Gisholt Saddle Type Turret Lathes.

There's longitudinal power rapid traverse for the hexagon turret carriage, of course. Furthermore, you'll find it provided for the longitudinal travel of the square turret carriage, and—an advantage pioneered by Gisholt—for transverse travel of the cross slide.

Quicker movement of tools in and out of cutting position reduces time between cuts. And it relieves the operator of laborious hand-turns—saves as much as one-third of his time on many jobs.

No wonder operators familiar with the *complete* traverse feature are strong for Gisholt. It helps them produce more, earn more, with less fatigue.



1. *For longitudinal traverse of the square turret.*

2. *For cross traverse of the cross slide.*

3. *For longitudinal traverse of the hexagon turret.*

GISHOLT

GISHOLT MACHINE COMPANY

1209 *East Washington Avenue* • *Madison 3, Wisconsin*

Look Ahead... Keep Ahead... With Gisholt Improvements in Metal Turning

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

"SIP" Profile Projector

The Cosa Corporation, Chrysler Bldg., New York 17, N. Y., representative in the United States for Societe Genevoise d'Instruments de Physique, Geneva, Switzerland, announces that a product of this company, designated the "SIP" Profile Projector, Type AP-9, is now available. This instrument will project on a glass screen, 17 3/4 by 22 inches, the contour or profile of a variety of small precision work such as watch parts, ranging from platens to the tiniest pinions; tools such as taps, screw gages, worms, chasers, thread milling cutters and form tools; profile gages, master templets, and blanking dies; and parts employed in typewriters, accounting, and sewing machines.

The image or profile projected on the screen can be instantly gaged in reference to a master drawing, accurately measured with glass scales, or photographed. The projector can also be employed for the examination of surface quality on ground and polished objects and for detecting defects in various materials. The wide versatility of the projector makes it useful in the tool-room and for final inspection of precision parts, as well as for routine or operation inspection in actual production departments. It can even be employed by operators in place of micrometers or gages for controlling the size and shape of precision parts.

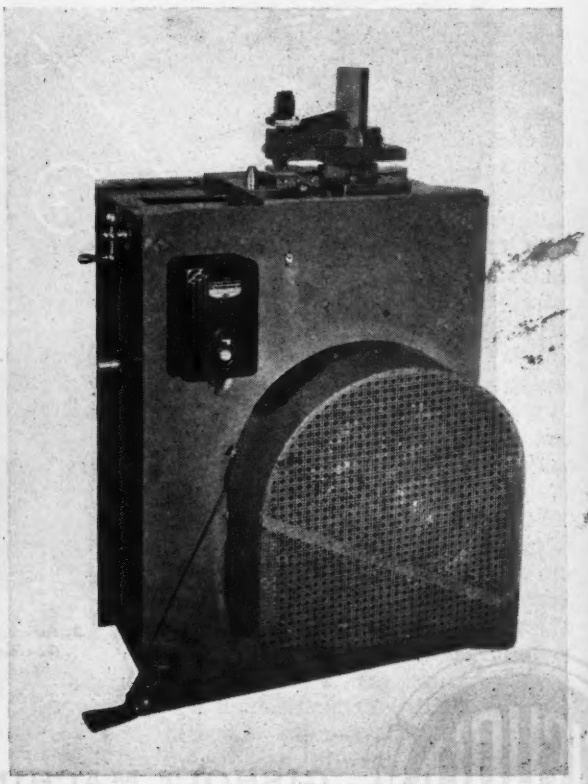
The images can be measured to an accuracy of 0.01 or 0.005 inch, which corresponds to 0.0001 or 0.00005 inch on the work at a magnification of 100X. The part to be examined is placed on the glass table, which can be rotated and at the same time moved in two directions horizontally by means of the compound slide. This mounting permits quick centering of the object and facilitates aligning the image with a drawing or with reference marks on the screen. The height of the table can be adjusted by means of a handwheel to focus the image on the screen. Parts as large as 1 3/4 by 2 3/16 inches can be projected with the 10-power objective. Interchangeable objectives for magnifications of 10X, 20X, 50X, and 100X can be supplied mounted on draw-tubes and adjusted and calibrated by the manufacturer.—86

Edward Hallander Notching Press

A notching press equipped with an indexing device which enables any desired number of slots or notches to be automatically cut in the edge of a sheet-metal disk has been brought out by the Edward Hallander Tool Co., 390 Belleville Ave., Bloomfield, N. J. This machine is especially adapted for notching rotor and stator laminations for electric motors and similar work. It can also be equipped for piercing any desired number of evenly spaced holes within its indexing range.

The notching press consists essentially of a crank-operated vertically reciprocated ram with a punch-holder and a spring-actuated stripper; an arbor on which the work is mounted, which can be adjusted to accommodate disks of any size within the capacity of the machine; and an arbor indexing mechanism driven from the punch crankshaft through gearing and a Geneva motion. The Geneva motion mechanism serves to automatically index the work after each punching stroke of the ram. The ram and

"SIP" Profile Projector Recently Placed on the American Market by the Cosa Corporation



Hallander Notching Press Equipped with Automatically Indexed Work-arbor

To obtain additional information on equipment described on this page, see lower part of page 238.

indexing movements stop automatically when the work is finished. Change-gears, including a back-gear train, can be quickly changed in accordance with data given on a chart, to obtain any desired number of indexing movements. The machine is entirely self-contained, the driving motor being located within the machine base. ——— 87

Colonial Presses Developed for Assembling Steel Sleeves in Cylinder Blocks

The special hydraulic presses illustrated in Figs. 1 and 2 were designed by the Colonial Broach Co., Detroit, Mich., for use in the application of an ingenious process developed for assembling eight steel sleeves in the bores of V-type cylinder blocks by a combination of shrinking the sleeves by refrigeration, expanding the bores by heating, and hydraulic pressing. These presses are now being used by a well-known engine manufacturer who worked out the process in cooperation with the Colonial Broach Co.

The steel sleeves are prepared for the assembling operation by a cold treatment while the V-blocks are being prepared by heating. The chilled sleeves are then pressed into the block, two at a time, on the dual press shown in Fig. 1. The cylinder block is indexed into position for pressing in each subsequent pair of sleeves. Spring-loaded plungers which contact index grooves on the side of the fixture slide insure alignment of the sleeves with the bores into which they are pressed.

When the block and liners return to room temperature after this operation, the assembled liners develop a tendency to "crawl" up out of the bores. It is, therefore, necessary to "set" the sleeves after cooling. The setting operation is performed on the special press shown in Fig. 2. This press applies a combination of hydraulic pressure and impact force. The platen of this press is inclined to automatically align each row of bores with the press plunger. Locating stops in the rest strip on the platen serve to position the cylinder block for each sleeve.

To set the sleeves, hydraulic pressure is applied by a piston in the ram. At the same time, air pressure lifts a weight above the hydraulic piston. At the top of the column, the weight is tripped and dropped on the hydraulic piston plunger. This produces an additional impact load which drives the sleeve and sets it in the cylinder bore. ——— 88

Scherr Tachometers

The George Scherr Co., 199 Lafayette St., New York 12, N. Y., has developed four precision hand tachometers designed to enable engineers to accurately determine the speed, in revolutions per minute, of any revolving shaft or part. These tachometers operate on the centrifugal principle, and have five speed ranges. A knurled ring provides a quick means for shifting speeds.

The speed ranges covered by the four models are: Model A, from 30 to 12,000 R.P.M.; Model B, from 45 to 18,000 R.P.M.; Model C, from 60 to 24,000 R.P.M.; and Model D, from 120 to 48,000 R.P.M. This wide range of speeds makes it possible to obtain the number of revolutions per minute of generators, combustion engines, trans-

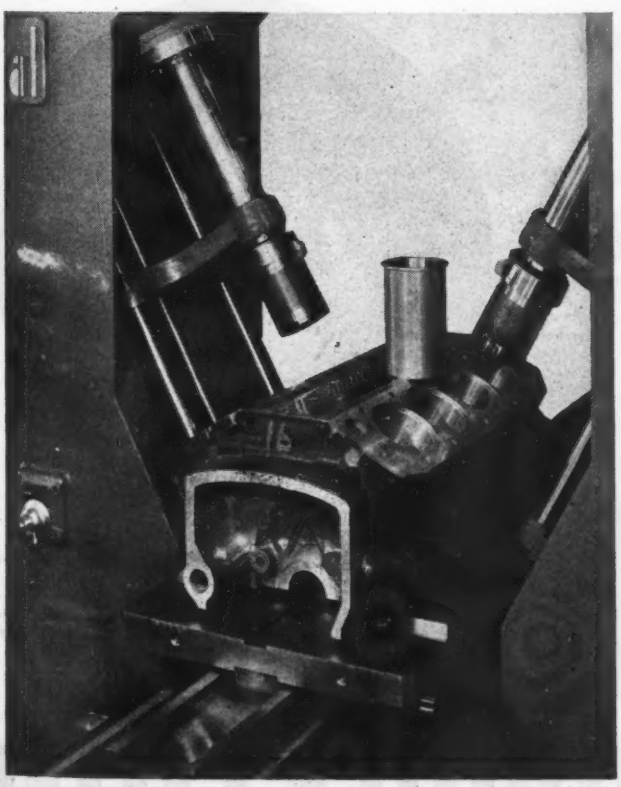


Fig. 1. Colonial Press Designed to Force Steel Sleeves into Preheated Cylinder Block

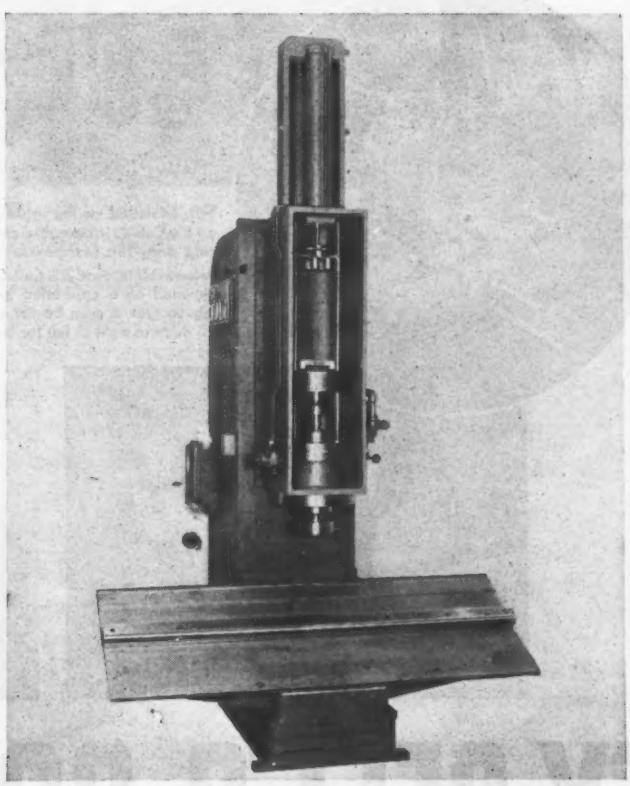
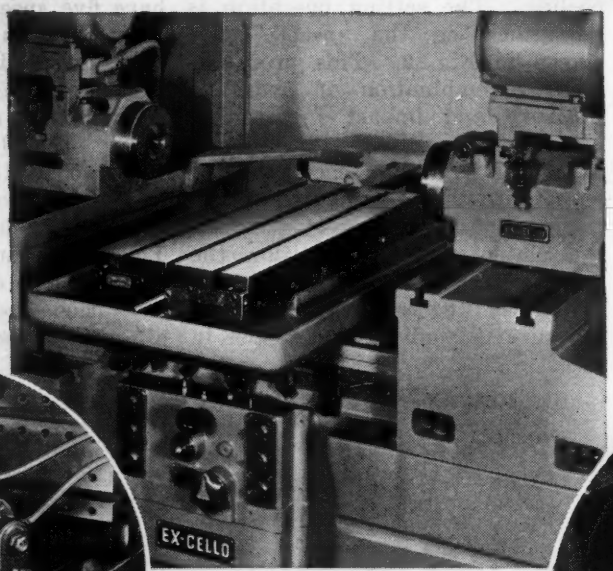


Fig. 2. Colonial Press Equipped to Set Steel Sleeves in Cylinder Block

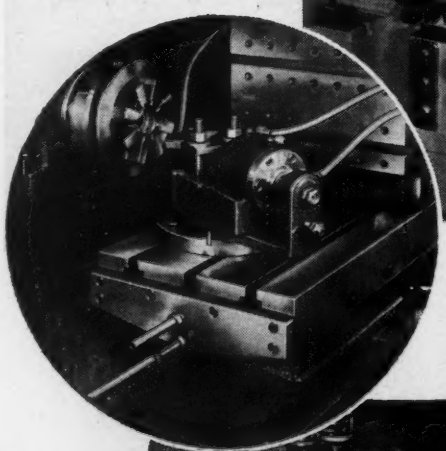
To obtain additional information on equipment described on this page, see lower part of page 238.

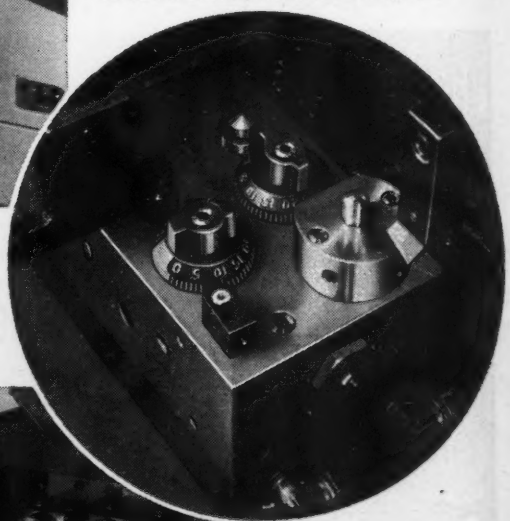
Flexibility IS THE



For finishing operations on job lots in all shapes and sizes, the Ex-Cell-O Precision Boring machine, shown at left, has proven ideal in a great many shops.

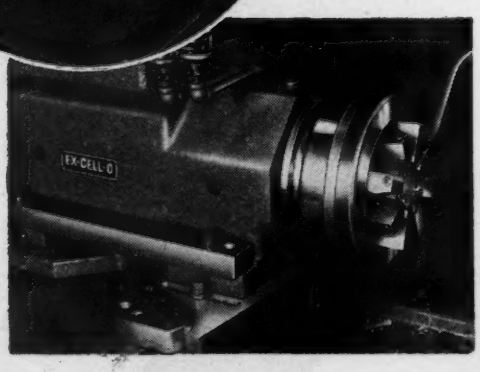
Below: An Ex-Cell-O standard adjustable cross feed slide is arranged with positive stop screws and an independent hydraulic panel.

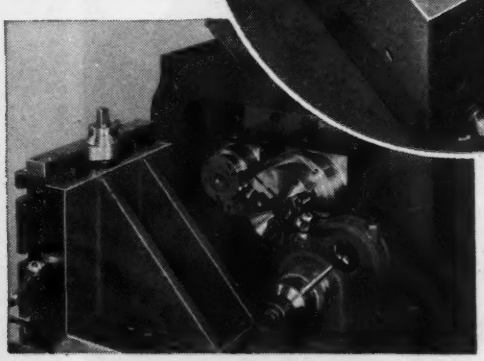




Left: Mounted on the table of this machine is an Ex-Cell-O adjustable cross feed slide with chip pan. This feature adds further versatility.

Below: Note that Ex-Cell-O boring head is mounted on a calibrated swivel-type mounting so that it may be set at any angle up to 16 degrees right or left for boring taper holes.





Shown at left are additional available items such as a three-jaw chuck for turning or boring, and a micrometer adjustable boring bar block.

EX-CELL-O CORPORATION

XLO

EX-CELL-O *for* PRECISION

KEYNOTE

EX-CELL-O Boring Machines have Many Advantages for General Purpose Work in Tool Rooms and Experimental Departments

The tremendous increase in *precision* boring throughout American industry has brought a demand for a simple, flexible machine to be used for general purpose work of this kind in experimental departments and toolrooms. Ex-Cell-O standard single-end and double-end precision boring machines, equipped with various attachments and tooling as illustrated here, are proving ideal in a great many shops for turning, facing and boring operations on job lots in different shapes and sizes . . . The boring heads are suitable either for quill mountings, or chuck mountings for a wide variety of work-piece sizes. An adjustable cross-feed slide with chip pan can be mounted on the machine table. A complete box travel motion may be obtained by using a combination of settings between the main machine table and the cross-slide. An additional feature is the optional use of a manually operated vertical slide with graduated dial . . . An Ex-Cell-O standard *precision* boring machine with a set-up like this may be the answer to your problem in experimental or toolroom work.

Send today to Ex-Cell-O for Bulletin No. 27121.

Standard and Special Multiple Way-Type Precision Boring Machines

•

Multiple Drilling and Other Special Purpose Machines

•

Precision Thread Grinding Machines

•

Precision Lapping Machines

•

Broaches and Broach Sharpening Machines

•

Continental Cutting Tools

•

Tool Grinders

•

Hydraulic Power Units

•

Grinding Spindles

•

Drill Jig Bushings

•

Fuel Injection Equipment

•

R. R. Pins and Bushings

•

Pure-Pak Paper Milk Bottle Machines

•

Aircraft and Miscellaneous Production Parts

45-57

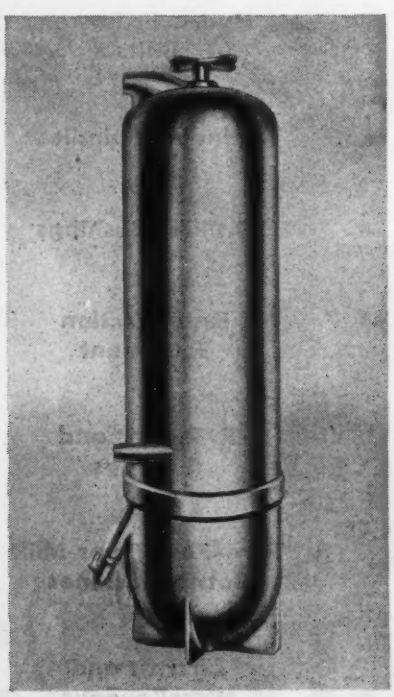
DETROIT 6, MICHIGAN

mission pulleys, textile machines, pumps, lathes, etc. The dial of each tachometer is individually calibrated to insure extreme precision. The speed of the revolving shafts can be measured as close as 1 R.P.M. Attachments are also provided for registering speeds in feet per minute. ——89

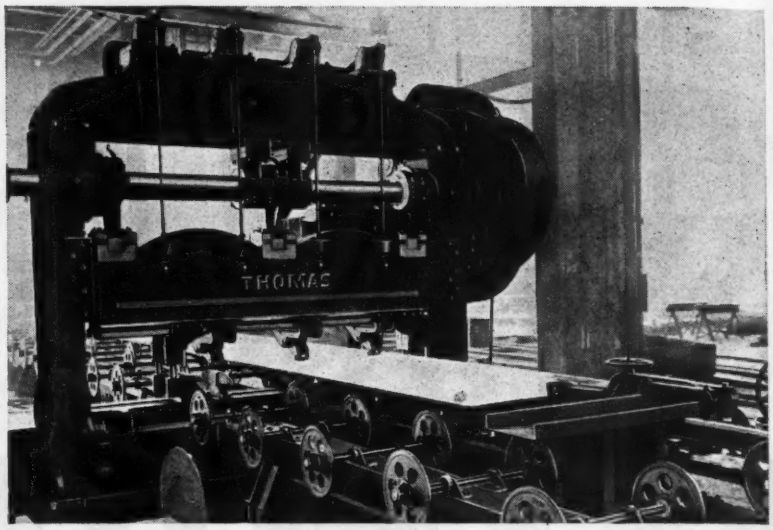
Cuno Filter for Grinder Coolant

A filter developed for cleaning grinder coolant and similar solid-bearing fluids, known as "Coolant-Klean," has been brought out by the Cuno Engineering Corporation, 133 S. Vine St., Meriden, Conn. This filter has been designed to reduce filter costs and the expense for their maintenance and replacement. It has a replaceable bag type filter element mounted on a screen spacer designed to provide a filtering area of 1000 square inches, which will insure a full flow of coolant or other liquid.

Replacement of the bag filter can be accomplished in less than five minutes. Installation of the complete unit between the grinder pump and the delivery nozzle at the work averages about fifteen minutes. Only two flexible hose connections are necessary, no extra pump, electrical work, plumbing, or valves being required. ——90



Cuno Coolant Filter



Edging Machine Designed to Prepare Plates for Automatic Welding

Thomas Edger Designed to Prepare Plates for Automatic Welding

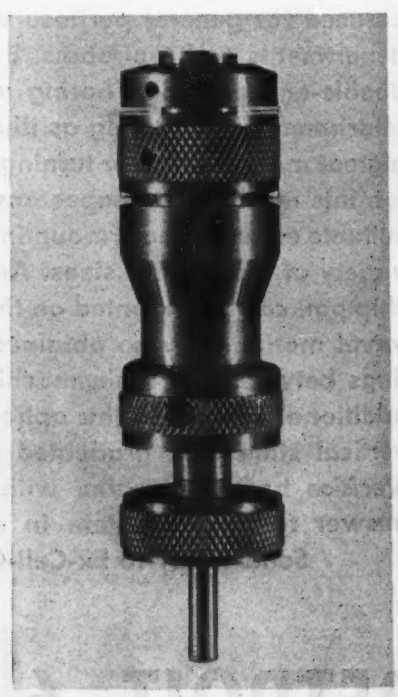
Substantial reductions in the time required for side edging or trimming of plates preparatory to joining them by automatic welding is made possible by a new trimmer brought out by the Thomas Machine Mfg. Co., Pittsburgh 23, Pa. By simultaneously trimming both side edges of the plate in one pass through the machine, the plate is made ready for automatic butt-welding in a fraction of the time required by conventional methods.

This new plate edger shears rather than planes the plates. The shear cut, in addition to being more rapid, is said to result in a tighter, more accurate joint between two plates. This advantage is obtained by two operating features — first, the plate is held perfectly flat while under the shear blades, so that "mill wave" is eliminated when the cuts are made; second, the plate is carried through the entire shearing cycle in the same relative position. This is accomplished by means of a combination of stop gages, extremely rigid holding of the work, and accurate methods of guiding the plate as it passes through the machine.

The finished plates have edges that are parallel within very close tolerances. The plate edger can be operated by one man, who need not be a skilled worker. In edging the larger and heavier plates, however, it is more economical to employ a helper for loading and unloading the work. Tool set-ups or changes can be made by the regular operator, only a wrench and a simple measuring tool being required for this work. The machine is manufactured in sizes and capacities for handling plates of any size or thickness that are assembled by automatic welding. ——91

Adjustable Flush-Pin Gage

An adjustable flush-pin gage with a micrometer tolerance adjustment ranging from 0.000 to plus or minus

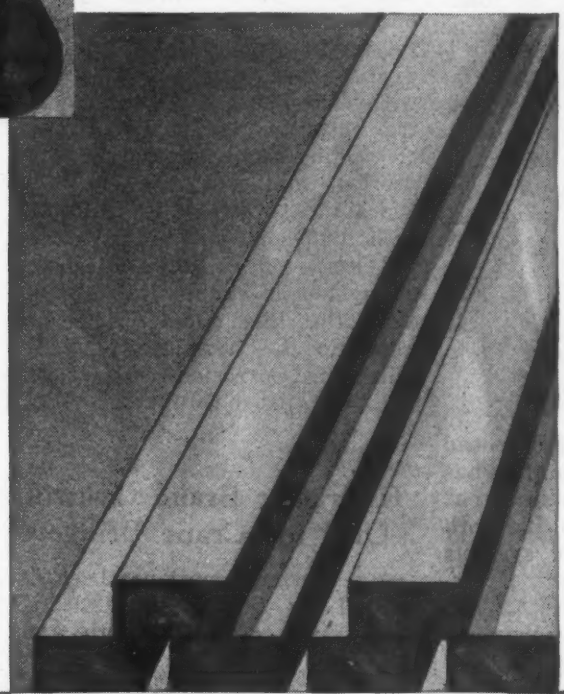


Adjustable Flush-pin Gage

To obtain additional information on equipment described on this page, see lower part of page 238.

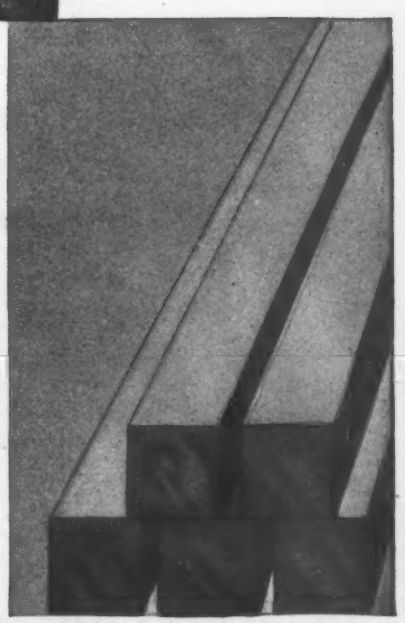
J&L HOT ROLLED BARS

J&L Hot Rolled Bars are available in round, hexagon, square, flat and bar sized angles. They conform to exacting standards for accuracy and finish and are stocked by J&L Warehouses and other distributors of J&L Controlled Quality Steel. Die-rolled sections and special shapes are, of course, made to your special order.



J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH 30, PENNSYLVANIA

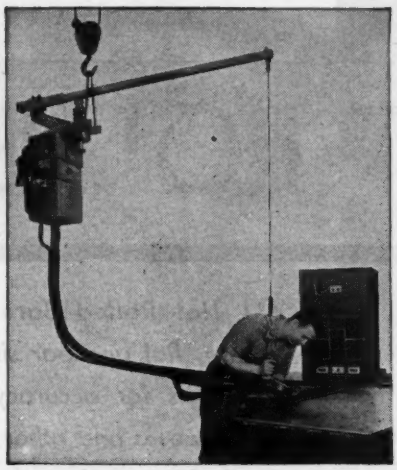


0.200 inch in steps of 0.001 inch has been developed by the Schnacke Mfg. Corporation, 1016 E. Columbia St., Evansville 7, Ind. The gage setting is simple, and is best explained by a typical example. To gage holes with a depth of 0.750 inch, plus 0.015 inch minus 0.000 inch: First, an interchangeable 1-inch gaging pin is attached to the gage and its effective length is reduced to 0.750 inch by inserting a 0.250-inch gage-block between the anvil member and the body member. Then a setting of 0.015-inch is made on the micrometer, which separates one of the lapped flush gaging surfaces located at the top of the gage by this amount. The gage is then placed on the workpiece, the pin drops into the hole, and the position of the upper end of the pin in relation to the tolerance step indicates whether the hole depth meets specifications.

Holes of a maximum depth of 3 inches plus 0.200 inch can be gaged through the interchangeability of three gaging pins, which are furnished as standard equipment, together with adjusting wrenches, spanners, and a fitted mahogany case. ——— 92

Sciaky Overhead Spot-Welders

A complete new line of overhead type portable spot-welding units has been announced by Sciaky Bros., 4915 W. 67th St., Chicago, Ill. Both pneumatic and hydraulic systems are available with transformer ratings of 50, 75, and 100 KVA. The equipment includes a variety of light-weight guns in both alligator and "C" types. Spring type or pneumatic balancers are provided for easy positioning of the gun. Transformers may be had with or without tap switch. Electronic control units are available for control of welding sequence, current interruption, and welding heat. The hydraulic system is equipped with a special fast-acting booster and electro-valve. In case of leakage, the system is automatically refilled from the line supplying cooling water to the transformer, cables, and gun. Corrosion-resistant materials are used throughout. ——93



Overhead Type of Spot-welder Made by Sciaky Bros.

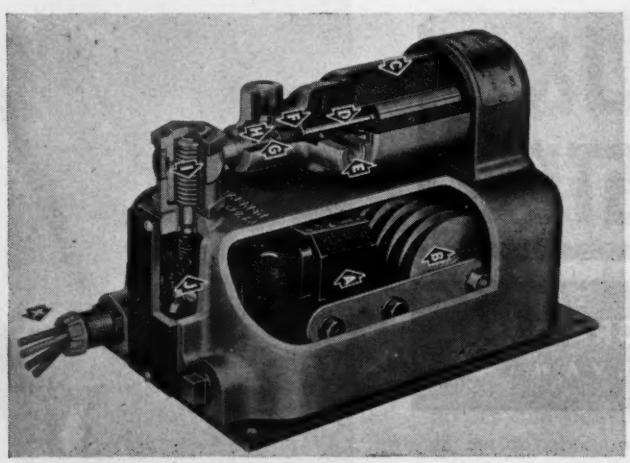
Hydraulic Brake Control Unit for Crane Bridges

A new control unit has been developed by the Wagner Electric Corporation, 6467 Plymouth Ave., St. Louis 14, Mo., for use on the company's Type HM crane bridge brake, which provides automatic "cushioned" emergency stopping when power fails or the crane runs beyond safe limits on the runway. This brake control unit permits free use of the foot-controlled hydraulic brake for service stops, and at the same time holds the parking brake setting spring compressed, ready to apply the brake in an emergency, as in the over-running of a limit switch or power failure. In either event, the "cushioned-stop" valve of the control unit applies the brake at a predetermined rate to bring the bridge and its load to a quick, but smooth, stop without undue swinging of the suspended load.

The brake is automatically applied when the operator pulls the main-line switch, which he does on taking the crane out of operation. To release the brake, the operator merely makes a full application of the foot-pedal. This compresses the brake setting spring, and the control unit holds it compressed until the electric circuit of the unit is opened. ——— 94

Pocket-Size Set of Surface Finish Standards

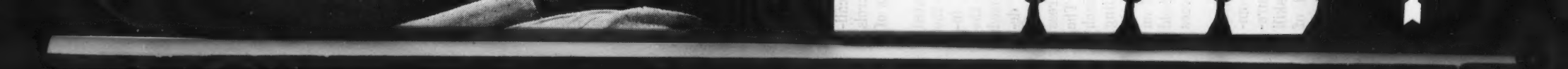
A light-weight, pocket-size set of twenty surface finish standards has been announced by the University Machine Co., Division of Baird Associates, 33 University Road, Cambridge, Mass. These sets enable manufacturers to specify and check surface roughness without the use of delicate instruments. A finger-nail drawn across the surface of a machined or ground part



Brake Control Unit for Crane Bridge Built by Wagner Electric Corporation

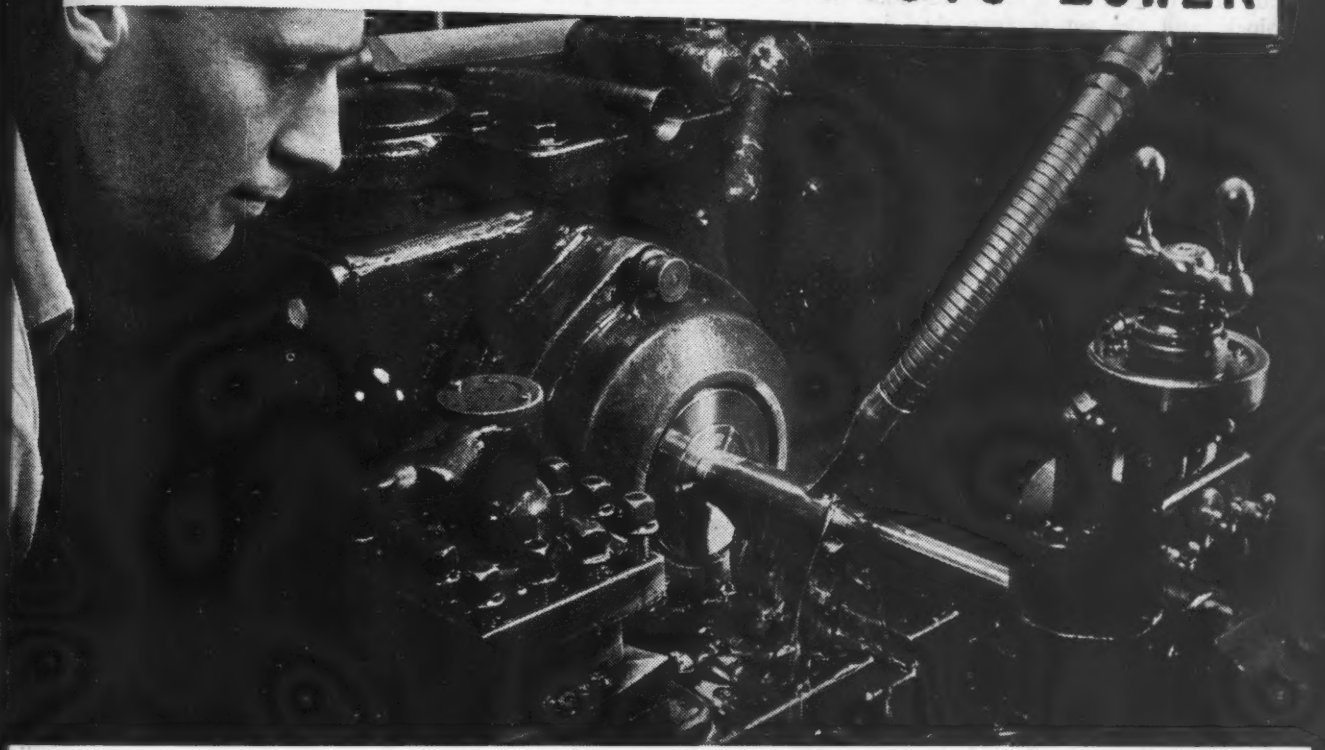
Pocket-size Set of Surface Finish Standards Made by University Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 238.



4 TOOLS LAST AS LONG AS 5

FINISHES BETTER...COSTS LOWER



SUNICUT...

Increases tool life by 25%...improves finishes

Turning . . . threading . . . tapping tough carbon steel, stainless steel and monel metal faster, better and at lower costs. That's the record of a large Pennsylvania shop when it switched to Sunicut.

Increased tool life and better finishes was the aim of the production manager. With Sunicut, he was able to obtain a saving of 25% in tool life, improve finishes on every operation and at the same time eliminated the necessity of various grades of cutting oils.

Outstanding transparency, high heat absorbing and excellent metal wetting qualities of Sunicut make possible longer tool life, finer finishes and increased operator interest. This clear, transparent, sulphurized cutting lubricant has proved its production value in the leading metal working plants of America.

In your plant let Sunicut help you increase the life of cutting tools, improve finishes, and step up production. If you are faced with a metal working problem, remember there's always a Sun Cutting Oil Engineer ready to help you . . . just write

SUN OIL COMPANY • *Philadelphia 3, Pa.*

Sponsors of the Sunoco News Voice of the Air—Lowell Thomas

SUNOCO

SUN INDUSTRIAL PRODUCTS

OILS FOR AMERICAN INDUSTRY

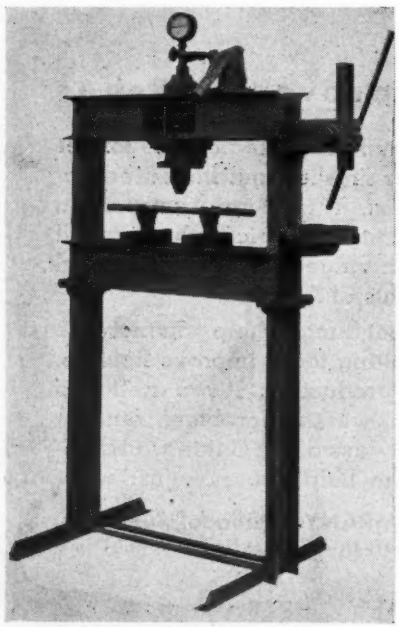
and then across the standard will detect differences of only a few millionths of an inch.

These sets cover a wide range of micro-inch finishes, and include standards for polishing, grinding, milling, shaping, and turning operations. Sets are available for both ordnance and aircraft standards. Each specimen is actually machine cut or ground from a stainless-steel block, and the set is furnished in a light Dow metal case. ——95

Mech-Art Hydraulic Press

Pressing, straightening, bending, flattening, assembling, and a variety of other operations can be performed on the new 25-ton hydraulic press now being manufactured by the Mech-Art Products Corporation, York, Pa. This press is self-contained, and can be located in any convenient place or moved about the shop as required. Power is applied by hand operation, eight strokes of the pump giving a ram travel of 1 inch.

Handle grips at the end of the table make possible immediate adjustment in the height of the table to facilitate handling work of various sizes. A 30-inch span between uprights permits handling long shafts. The table travel is 35 inches, the ram travel 4 1/2 inches, and the ram diameter 2 3/4 inches. The width between table channels is 5 1/8 inches. The press has a height of 60 inches, and requires a floor space of 34 by 27 1/2 inches. The weight is 420 pounds. ——96



Hydraulic Bending and Straightening Press Made by the Mech-Art Products Corporation

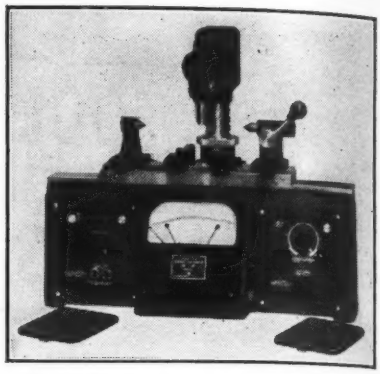
Multi-Purpose Speed Lathe

A small, light-duty speed lathe designed for the rapid economical handling of finishing jobs on small metal and plastic parts has been placed on the market by the Schauer Machine Co., 2069A Reading Road, Cincinnati, Ohio. Simple accessible adjustments serve to facilitate operation of this machine. The hand operating lever, for example, can be set on the right- or left-hand side of the lathe, and in either the vertical or horizontal position, to suit the operator.

Schauer Speed Lathe Designed for Finishing Small Parts

Only 5 pounds pressure on the operating lever is required to open the collet. A simple adjustment affords the choice of two operation sequences. In one case, the operating lever serves to open the motor circuit, apply the brake, and open the collet. In the other case, the motor operates continuously, the brake is locked out, and the operating lever is used only to open and close the collet.

The 1/4-H.P., single-speed motor operates at 3450 R.P.M. on a 220-440-volt, 60-cycle, three-phase circuit. The machine is designed to use a Type 3C collet with a maximum capacity for holding 1/2-inch round stock. It can also be equipped with a 3-inch, three-jaw, light-duty chuck. There is a 1/2-inch hole through the spindle which permits the handling of bar stock or long pieces of work. ——97



Surface Smoothness Comparator

Comtor Surface Smoothness Comparator

The quick-scanning surface comparator recently developed by the Comtor Co., Waltham, Mass., provides a new means for inspecting the smoothness of finished surfaces. This comparator consists of a photo-electric scanning head, a self-contained amplifier with calibrating controls, a finish meter with tolerance markers, and a ball-bearing work-holding carriage.

Critical adjustment of the scanning head is unnecessary. Its response, although sensitive to the smallest differences in smoothness, is independent of the direction of the finish grain. The amplifier is contained in the base of the comparator, and its zero setting, calibrating, and sensitivity controls are mounted on the front panels of the base.

The finish meter is so graduated that the readings represent the smoothness of the part to be inspected as a percentage of the smoothness of the standard used for setting the comparator. If desired, this value can be converted to units currently used to express surface finish smoothness. The work-holding carriage has a 7-inch travel and a capacity for holding cylindrical work up to 6 inches in diameter. Flat parts are placed on the table, and cylinders are held between centers or placed on vees equipped with Norbide inserts.

This instrument can be operated as rapidly as the conventional comparators used for size measurements, and requires no more skill for its operation. A standard of known surface finish quality is placed on the work-holding table; the finish meter is then set and its tolerance mark is adjusted to make it ready for shop use. ——98

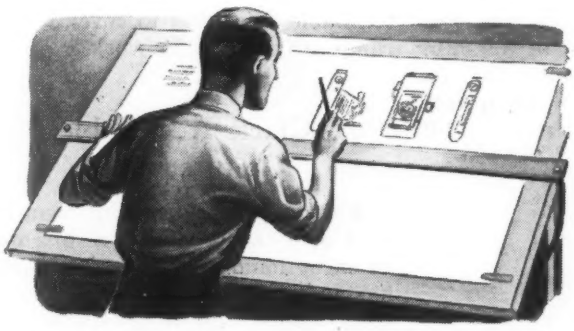
To obtain additional information on equipment described on this page, see lower part of page 238.

TROUBLES SUBSIDE

It was a slow and troublesome job to drive small slotted screws in fastening a pressed fabric panel on this electrical relay for the P-80 Jet Plane. Frequent driver skids gouged the special fungus-resistant varnish, forced disassembly and junking of marred panels.

OUTPUT HITS STRIDE

Assembly of this part was speeded up 400% when a change was made to Phillips Recessed Head Screws. Fumbling was ended, and a spiral driver could be used, permitting faster driving. Driver skids were eliminated, along with waste of parts and time for disassembly and reassembly.



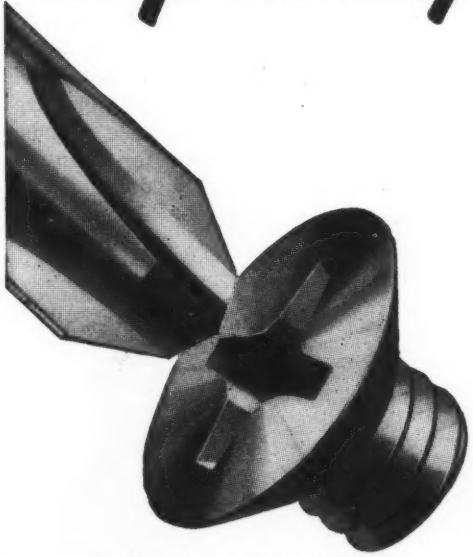
NEW STRENGTH SUPPLIED

Design engineers favor Phillips Screws, because they not only speed output and reduce costs . . . they also permit design improvements that add strength, often with the use of fewer screws. This advantage is especially evident in compact, complicated assemblies.

SHOW IT WITH PRIDE

Wherever screw heads are exposed, the Phillips Recess adds a sales advantage. No unsightly burrs to snag clothing or nick fingers – and sidetrack sales! Its ornamental design blends with modern contours – and it needs only a quarter turn to line up – looks well in any position.

It's Phillips — the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

. . . It's the exact pitch of the angles that eliminates driver skids.

. . . It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

. . . It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

25 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
The Steel Company of Canada Ltd., Hamilton, Canada
Wolverine Bolt Co., Detroit, Mich.

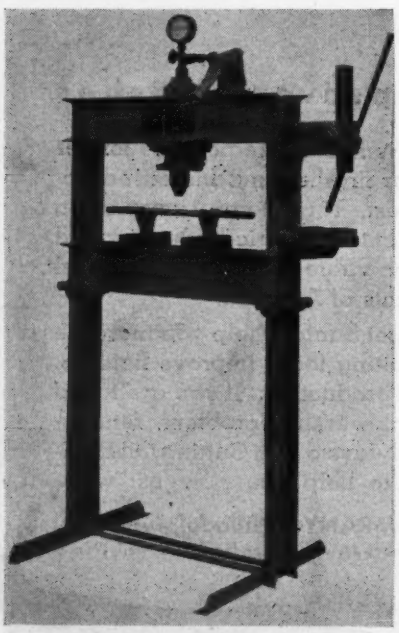
and then across the standard will detect differences of only a few millionths of an inch.

These sets cover a wide range of micro-inch finishes, and include standards for polishing, grinding, milling, shaping, and turning operations. Sets are available for both ordnance and aircraft standards. Each specimen is actually machine cut or ground from a stainless-steel block, and the set is furnished in a light Dow metal case. ——95

Mech-Art Hydraulic Press

Pressing, straightening, bending, flattening, assembling, and a variety of other operations can be performed on the new 25-ton hydraulic press now being manufactured by the Mech-Art Products Corporation, York, Pa. This press is self-contained, and can be located in any convenient place or moved about the shop as required. Power is applied by hand operation, eight strokes of the pump giving a ram travel of 1 inch.

Handle grips at the end of the table make possible immediate adjustment in the height of the table to facilitate handling work of various sizes. A 30-inch span between uprights permits handling long shafts. The table travel is 35 inches, the ram travel 4 1/2 inches, and the ram diameter 2 3/4 inches. The width between table channels is 5 1/8 inches. The press has a height of 60 inches, and requires a floor space of 34 by 27 1/2 inches. The weight is 420 pounds. ——96



Hydraulic Bending and Straightening Press Made by the Mech-Art Products Corporation

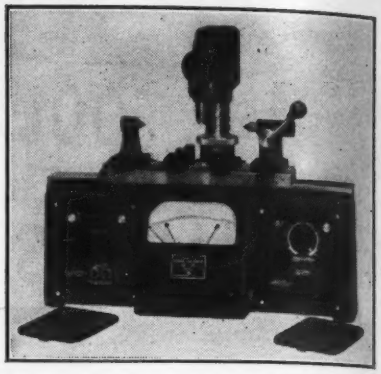
Multi-Purpose Speed Lathe

A small, light-duty speed lathe designed for the rapid economical handling of finishing jobs on small metal and plastic parts has been placed on the market by the Schauer Machine Co., 2069A Reading Road, Cincinnati, Ohio. Simple accessible adjustments serve to facilitate operation of this machine. The hand operating lever, for example, can be set on the right- or left-hand side of the lathe, and in either the vertical or horizontal position, to suit the operator.

Schauer Speed Lathe Designed for Finishing Small Parts

Only 5 pounds pressure on the operating lever is required to open the collet. A simple adjustment affords the choice of two operation sequences. In one case, the operating lever serves to open the motor circuit, apply the brake, and open the collet. In the other case, the motor operates continuously, the brake is locked out, and the operating lever is used only to open and close the collet.

The 1/4-H.P., single-speed motor operates at 3450 R.P.M. on a 220-440-volt, 60-cycle, three-phase circuit. The machine is designed to use a Type 3C collet with a maximum capacity for holding 1/2-inch round stock. It can also be equipped with a 3-inch, three-jaw, light-duty chuck. There is a 1/2-inch hole through the spindle which permits the handling of bar stock or long pieces of work. ——97



Surface Smoothness Comparator

Comtor Surface Smoothness Comparator

The quick-scanning surface comparator recently developed by the Comtor Co., Waltham, Mass., provides a new means for inspecting the smoothness of finished surfaces. This comparator consists of a photo-electric scanning head, a self-contained amplifier with calibrating controls, a finish meter with tolerance markers, and a ball-bearing work-holding carriage.

Critical adjustment of the scanning head is unnecessary. Its response, although sensitive to the smallest differences in smoothness, is independent of the direction of the finish grain. The amplifier is contained in the base of the comparator, and its zero setting, calibrating, and sensitivity controls are mounted on the front panels of the base.

The finish meter is so graduated that the readings represent the smoothness of the part to be inspected as a percentage of the smoothness of the standard used for setting the comparator. If desired, this value can be converted to units currently used to express surface finish smoothness. The work-holding carriage has a 7-inch travel and a capacity for holding cylindrical work up to 6 inches in diameter. Flat parts are placed on the table, and cylinders are held between centers or placed on vees equipped with Norbide inserts.

This instrument can be operated as rapidly as the conventional comparators used for size measurements, and requires no more skill for its operation. A standard of known surface finish quality is placed on the work-holding table; the finish meter is then set and its tolerance mark is adjusted to make it ready for shop use. ——98

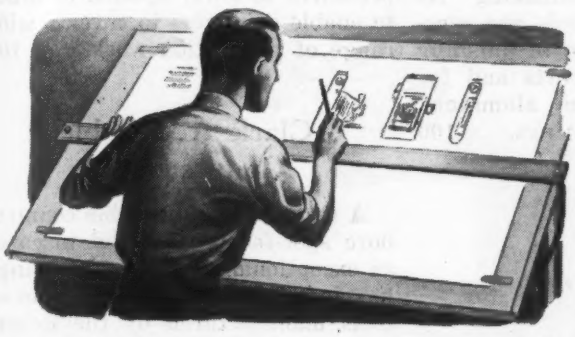
To obtain additional information on equipment described on this page, see lower part of page 238.

TROUBLES SUBSIDE

It was a slow and troublesome job to drive small slotted screws in fastening a pressed fabric panel on this electrical relay for the P-80 Jet Plane. Frequent driver skids gouged the special fungus-resistant varnish, forced disassembly and junking of marred panels.

OUTPUT HITS STRIDE

Assembly of this part was speeded up 400% when a change was made to Phillips Recessed Head Screws. Fumbling was ended, and a spiral driver could be used, permitting faster driving. Driver skids were eliminated, along with waste of parts and time for disassembly and reassembly.



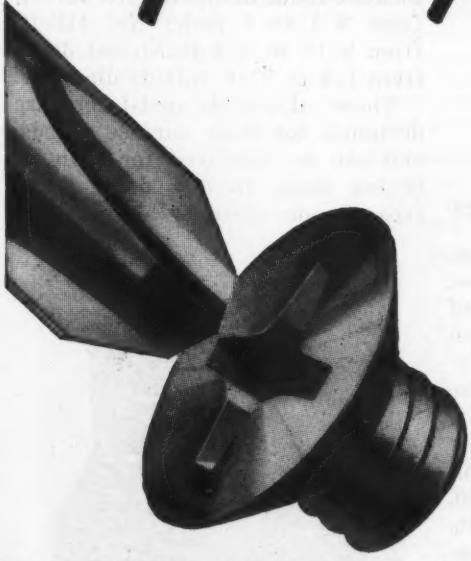
NEW STRENGTH SUPPLIED

Design engineers favor Phillips Screws, because they not only speed output and reduce costs . . . they also permit design improvements that add strength, often with the use of fewer screws. This advantage is especially evident in compact, complicated assemblies.

SHOW IT WITH PRIDE

Wherever screw heads are exposed, the Phillips Recess adds a sales advantage. No unsightly burrs to snag clothing or nick fingers – and sidetrack sales! Its ornamental design blends with modern contours – and it needs only a quarter turn to line up – looks well in any position.

It's Phillips — the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

. . . It's the exact pitch of the angles that eliminates driver skids.

. . . It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

. . . It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

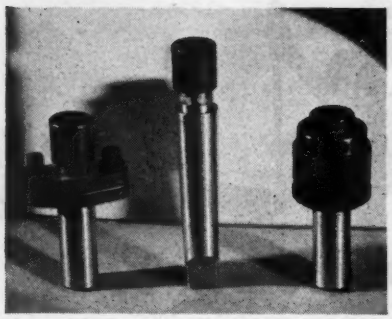
PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

25 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
The Steel Company of Canada Ltd., Hamilton, Canada
Wolverine Bolt Co., Detroit, Mich.



Kett Chuck and Floating Tool-holders

Kett Floating Tool-Holder

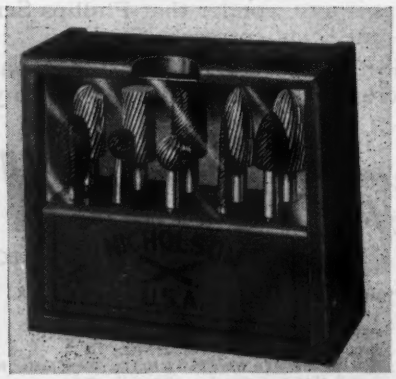
A floating tool-holder of radically new design is included in the line of chucks and floating holders being placed on the market by the Kett Tool Co., 5 E. Third St., Cincinnati 2, Ohio. The new chucking tools embody the Kett three-jaw power grip as an integral unit. The accuracy, gripping power, and long life of these tools, combined with their unusual small size, make them especially well adapted for holding drills, reamers, and small taps for operations performed on screw machines, lathes, and drill presses.

Drills in sizes from No. 80 to 1/4 inch in diameter can be held in the Kett chuck without changes of any kind, a feature that eliminates the need for carrying a large assortment of bushings and collets. This new Kett line includes taper-arbor and straight-shank chucks in various shank sizes and in two types of floating tool-holders. 99

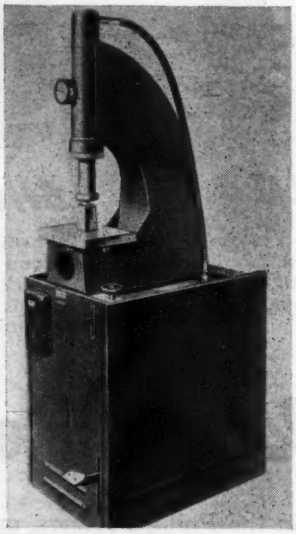
Nicholson Rotakit

The Nicholson File Co., 18 Acorn St., Providence 1, R. I., has just brought out the "Rotakit" shown in the accompanying illustration, which consists of an assortment of rotary files and burrs contained in an attractive case. The case, built in the form of a miniature bench stand, makes the files readily accessible when not in use. The glass front of the kit permits a full view of the files and protects them from dust.

Rotakit No. 20 contains ten ground burrs; No. 30, ten hand-cut rotary files; and No. 40, five ground burrs and five hand-cut rotary files. From these kits, the mechanic can select an assortment of tools to meet his patternmaking, mold-finishing, die-sinking, and toolmaking requirements. These tools are especially adapted for use in finishing small and intricate parts and for removing scale from aluminum, brass, and bronze castings. 100



Rotakit Assortment of Rotary Files and Burrs



Self-contained Motor-driven Hydraulic Press

Munton Hydraulic Presses

A versatile line of positive-action, self-contained hydraulic presses, adaptable to all sizes and types of shop work, has recently been brought out by the Munton Mfg. Co., Franklin Park, Ill. These presses are available with a self-contained motor drive suitable for production work. They are built in capacities of 4 1/2, 7, 10, 15, 20, and 25 tons, with means for limiting the applied pressure as required. Gages are provided which show the pressures being applied when the presses are used in laboratories or for testing purposes.

A holding valve can be obtained as extra equipment with these presses to enable them to be used for certain molding or glue-welding operations which require the ram to be held under pressure until the lever is tripped. These presses are being used for operations such as push-broaching, forming, blanking, drawing, squeeze assembling of bushings, straightening, shot-pushing, and numerous other operations requiring a positive, powerful pushing force which can be accurately controlled.

The press rams are made interchangeable on the various presses to permit obtaining greater speeds with lower pressure rams or higher pressures at lower speeds, in order to enable one press to cover a wide range of production work. 101

Clark Adjustable Counterbores

A set of four adjustable counterbore spot-facers designed to cover an exceptionally wide cutting range has just been added to the line of tools manufactured by the Robert H. Clark Co., 9330 Santa Monica Blvd., Beverly Hills, Calif. This set, identified as No. CS-1H, covers a capacity range for cutting or spot-facing a surface of any fractional or decimal diameter from 1/4 inch to 1 3/8 inches. Each tool can be quickly and easily adjusted to a wide range of sizes.

The Model No. 43B-H has a cutting range of from 1 inch to 1 3/8 inches outside diameter; No. 42B-H, from 3/4 to 1 inch; No. 41B-H, from 9/16 to 3/4 inch; and 40-H, from 1/4 to 9/16 outside diameter.

These adjustable spot-facers are designed for high surface speeds, and can be employed for counterboring holes to any depth. The cross-lip or shoulder design pre-

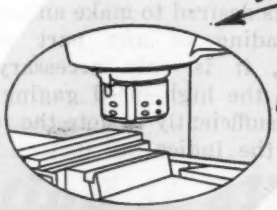
Adjustable Counterbores Made by Robert H. Clark Co.

To obtain additional information on equipment described on this page, see lower part of page 238.

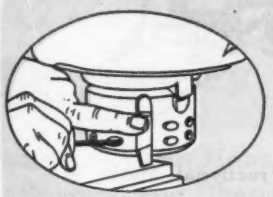
KENNAMILLING

A *Simple* MEANS TO DO HIGH RATE CARBIDE MILLING, ON *ALL* TYPES OF METAL, WITH AVAILABLE EQUIPMENT

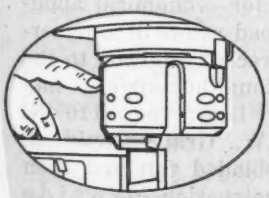
THE KENNAMILL FOR *Face-Milling*



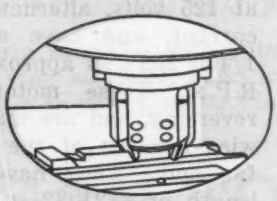
1. Table is adjusted so that distance between surface of work and bottom of cutter head is equal to depth of cut, plus 1/8" for clearance.



2. Blade is locked in No. 1 slot, positioned so its nose rests on workpiece. Table is withdrawn, adjusted to desired depth of cut, then a swath is fly-cut in workpiece.

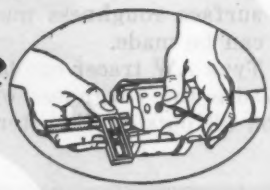


3. Fly-cut swath in workpiece provides a corner into which second, third, and fourth blades are fitted.

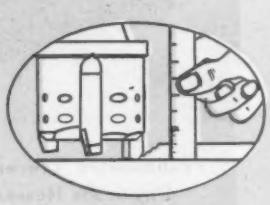


4. With face-mill setting, maximum production is obtained where available power is adequate to permit chip loads of over .005".

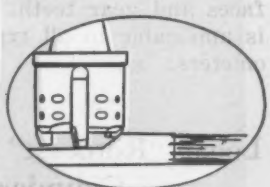
THE KENNAMILL FOR *Step-Cutting*



1. Kennametal-tipped blades, made especially for Kennamills, are set in cutter head, to a scale.



2. Work is distributed over four blades by dividing the desired depth of cut into four steps.



3. With step-cut setting, high rates of milling are possible where power is a limiting factor.

VERSATILE Kennamill Step-Cutters extend profitable application of the exceptional metal-cutting ability of tough, hard Kennametal. The cutter head is a permanent toolholder which can be used for high rate carbide milling on steel, cast-iron, and non-ferrous materials simply by interchanging blades having tips of the proper grade of Kennametal.

ADAPTABLE The Kennamill is adaptable for either step-cutting or face milling, as illustrated. Standard 39M40 blades (steel-cutting) and 39K40 blades (for cutting cast iron and non-ferrous materials) have a cutting edge 3/16" long, which provides for cuts up to 1/2" deep, with step-cut setting. By grinding a longer cutting edge, these blades are used for cuts up to 1/2" or more, with the face-mill setting.

ECONOMICAL Initial cost of Kennamill cutter head is low; replacement blades are inexpensive; and major operating economies are effected because: The Kennamill is easy to set-up; Down time is minimized because cutter head does not have to be removed from machine for blade replacement; Blades can be reground on simple carbide tool grinder.

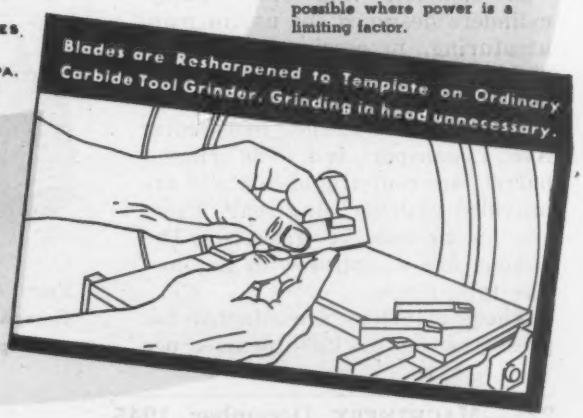
PROFITABLE The Kennamill is one of the most *useful* and *profitable* tools you can install because: *It enables you to do diversified milling jobs, at high production rates, at less cost, with available equipment.*

Catalog 45 gives full particulars on Kennamilling.
A copy is yours for the asking.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL *Inc.*, LATROBE, PA.

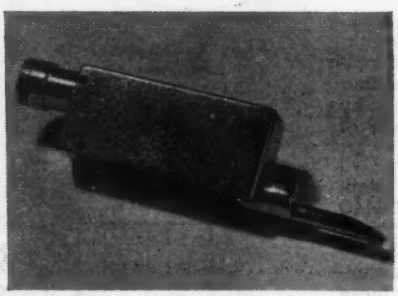


vents burrs from forming around the edge of the pilot hole and eliminates galling and binding. The pilots of these tools are hardened and ground. The high-speed steel blades can be readily sharpened or replaced. ---------- 102

Profilometer Tracer

The range of surface finish on which roughness measurements can be made has been greatly increased by the Type AW profilometer tracer brought out by the Physicists Research Co., Department 2, Ann Arbor, Mich. Used in conjunction with the profilometer, this tracer greatly increases the versatility, efficiency, and convenience with which surface roughness measurements can be made.

The Type AW tracer can be used to measure the roughness of surfaces on all outside diameters and



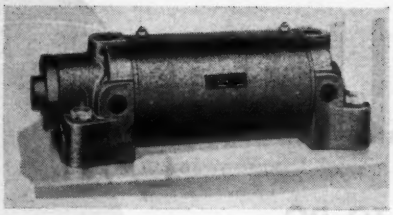
Profilometer Tracer Made by Physicists Research Co.

on all inside diameters down to 1/4 inch. It will also measure both internal and external tapered surfaces and gear teeth. This tracer is applicable to all types of profilometers. ---------- 103

Logan "Rotocast" Hydraulic Cylinders

A complete line of hydraulic cylinders designed for use in manufacturing, processing, and material-handling equipment has been placed on the market by the Logansport Machine Co., Inc., 910 Center Ave., Logansport, Ind. The cylinder barrels are centrifugal-cast and are provided with "O" ring seals. There are no tie-rods or gaskets. The pistons are equipped with automotive type rings.

These cylinders are adapted for pressures up to 1500 pounds per



"Rotocast" Hydraulic Cylinder

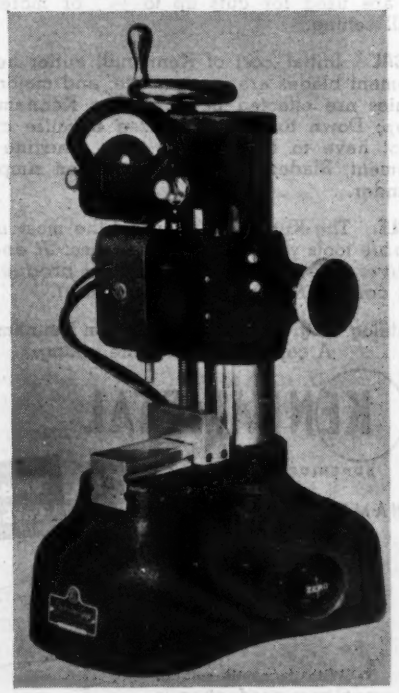
square inch. They are made in seven mounting types, three piston-rod models, and nine standard bores. They are available with cushioning at one or both ends, as desired. Although these cylinders are designed primarily for oil service, they can be used for water service if the water is treated. If untreated water must be used, cylinders of special material can be supplied. ---------- 104

Pratt & Whitney Electrolimit External Comparator

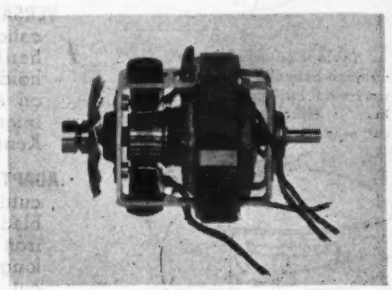
An Electrolimit comparator with limit-indicating lights, which provides an exceptionally fast and accurate means of inspecting parts, has been brought out by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford 1, Conn. The equipment consists of a P & W electric contact unit combined with a P & W Electrolimit head. The small neon tube lights which indicate under- or over-size dimensions are positioned at the sides of the meter, so that one line of vision covers both lights and meter.

By simply watching the limit lights, the operator can determine instantly whether the part is under size, over size, or within the required limits. The minus light on the left, being normally on, remains on if the part being inspected is under size. When the part is over size, the minus light goes off and the plus light on the plus side flashes on. When the part is within the predetermined limits, both lights are off.

If it is desired to make an actual-size reading of any part being checked, it is only necessary to slow up the high-speed gaging operation sufficiently to note the reading on the indicating meter.—105



Pratt & Whitney Electrolimit Comparator Developed for Rapid Inspection Work



Universal Fractional Motor of New Series Brought out by Lear, Inc.

Lear Universal Motors

A new V series of universal motors designed for economical application to a broad range of commercial uses is a recent addition to the line of fractional-horsepower motors made by Lear, Inc., 110 N. Ionia Ave. N.W., Grand Rapids 2, Mich. A ten-bladed fan and open laminated construction provide maximum cooling efficiency for these motors, which are designed for continuous duty.

The VC type motors are rated at 125 volts, alternating or direct current, and have an output of 1/100 H.P. at approximately 7500 R.P.M. These motors are non-reversing, and are made for clockwise rotation of the shaft at the fan end. They have an over-all length of 3 21/32 inches, and are approximately 2 1/8 inches in di-

To obtain additional information on equipment described on this page, see lower part of page 238.

Now you can find it all UNDER ONE COVER . . . . 232 pages

- Hobbing and Hobs
- Shaping and Shaper Cutters
- Gear Cutters
- SHEAR-SPEED Gear Cutting
- Gear Finishing and Gear Finishing Machines
- Gear Lapping and Gear Lapping Equipment
- Gear Checking and Checking Equipment
- Gear Finishing Tools
- Master Gears
- Engineering Data for the Gear Producer

Probably the most important helical and spur gear combined production manual and catalog ever issued.

Published by GEAR PRODUCTION HEADQUARTERS.

In view of the paper shortage, distribution is restricted to those having an actual need for such a book. Please ask for it on your Company letterhead.

MICHIGAN TOOL COMPANY 7171 E. McNICHOLS RD. Detroit 12, Mich., U.S.A.

ameter. The shaft at the fan end is regularly fitted with a 15/32-inch pulley, but special shafts or pinions can be furnished to meet individual requirements.

The VD type motors are also rated at 125 volts, alternating or direct current, and have an output of 1/30 H.P. at 7500 R.P.M. They have an over-all length of 4 3/8 inches, and are approximately 3 inches in diameter. In addition to special output shafts, other optional features of this series of motors include a radio interference capacitor and mountings for a variety of installations. 106

Redmer Foot Control and Valve for Air-Operated Equipment

The new foot control here illustrated was developed by the Redmer Air Devices Corporation, 601 W. Washington Blvd., Chicago 6, Ill., to meet the demand for an air control of low cost but constructed along the same lines as the higher-priced controls. Its valve consists of a brass casting designed to withstand the abuse to which such parts are frequently subjected. The construction of the device is simple, and the cost of replacement parts is said to be practically negligible.

The foot-pedal is designed for easy operation. Opening and closing of the plunger of the valve on the foot-pedal base are accomplished by means of a roller on the pedal casting, which serves to lessen the wear on the plunger, and at the same time facilitates operation. The valve can be removed from the foot control and used as a separate unit in conjunction with an actuating cam. 107

Foot Control and Valve for Air-operated Equipment

Woodworth Air-Operated Diaphragm Chucks

The N. A. Woodworth Co., 1300 E. Nine Mile Road, Detroit 20, Mich., has brought out a diaphragm chuck which is adaptable to various types of machine tools and which can be actuated either manually or by compressed air. The jaws of this chuck are rigidly fixed to a steel diaphragm which is pushed forward by a rod, thus causing the jaws to open sufficiently to receive the part to be machined. When the push-rod is released, the diaphragm tends to assume its original position, causing the jaws to securely grip the work.

The chuck is supplied with or without a work-stop. The standard jaws will accommodate work up to 1 inch in diameter by 4 inches long or 1 1/4 inches in diameter by 1 1/4 inches long. However, specially designed jaws can be used for parts up to 4 inches in diameter. Four jaws are ordinarily used, but this number can be increased or decreased to suit the job. The jaws are finish-ground or bored after the chuck is mounted on the machine on which it is to be used, thus insuring concentricity with the work-spindle. The chuck is suitable for rotating speeds up to 3600 R.P.M.

The chucks shown in Fig. 1 are mounted on a diamond boring machine for an internal form-boring operation. These chucks are operated by air pressure, and are individually controlled by the two knobs at the side of the machine. A small plunger in the center of each chuck knocks the finished parts out into the operator's hand when air pressure is applied to release the chuck. The chuck shown in Fig. 2 is arranged for use in machining work that must be clamped internally. 108

"Servotron" Electronically Controlled Variable-Speed Drive

The development of a variable-speed drive known as the "Servotron," in which the speed is controlled electronically, has just been announced by the Submarine Signal Co., 160 State St., Boston 9, Mass. Although this company has for some time supplied machine tool builders with a similar variable-speed drive, the new model embodies several improved features.

The drive operates on alternat-

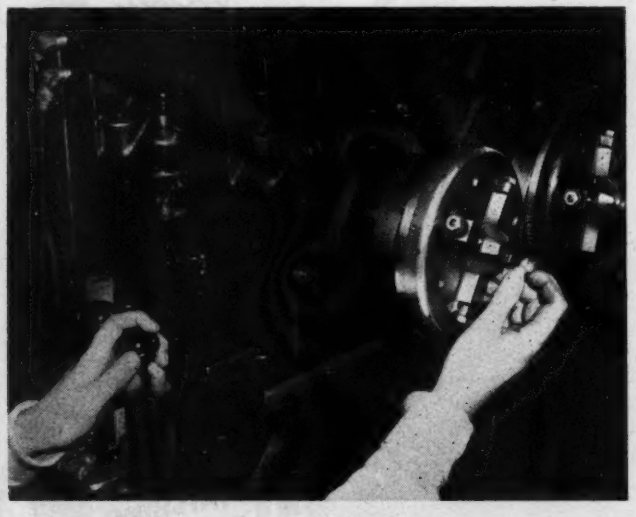


Fig. 1. Woodworth Air-operated Diaphragm Chucks Mounted on Diamond Boring Machine

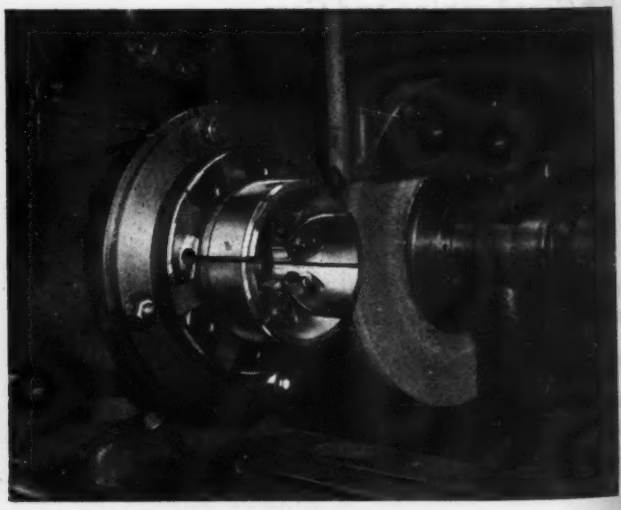
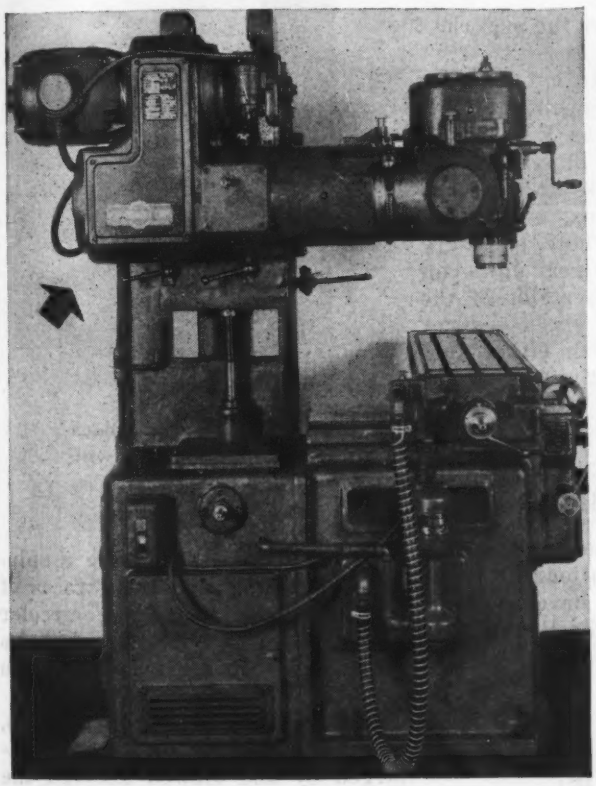


Fig. 2. Woodworth Diaphragm Chuck as Arranged to Grip Internal Surface of Work

To obtain additional information on equipment described on this page, see lower part of page 238.

Give Your Production a Permanent Boost!

INSTALL REEVES-EQUIPPED MACHINES



Typical Example Spindle speeds on this new Reed-Prentice No. 12-V Tool Room Milling Machine are infinitely variable through a REEVES Motodrive incorporated within framework of adjustable ram. Operator secures any speed from 97 to 1930 r.p.m. merely by pressing a button. Does face or straddle milling as well as boring, drilling, die-sinking and duplicating.

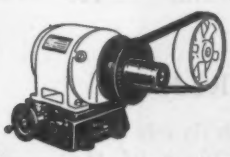
● Reconversion is creating a lot of production problems. Many manufacturers, perhaps yourself among them, are bringing out new products . . . dealing with new shapes and sizes . . . new materials and processes . . . all of which will be subject to later changes and refinements.

For this reason farsighted management is on the lookout for machines that are easily adaptable to variations in the production setup . . . machines that will *not* become "white elephants" when product specifications are altered . . . machines that will give production a *permanent* boost.

Any machine equipped with a REEVES Variable Speed Drive is a more versatile machine . . . more flexible and more adaptable to changing requirements. Speeds can be adjusted with precision over a wide range. Each operation can be performed at the most efficient speed to assure highest *quantity* and *quality*. The REEVES-equipped machine can turn out a greater variety of work. Without shutting down his machine, the operator can instantly select the speed that matches his skill . . . that is best for each size, shape or type of material . . . that is in step with any change in the complete production schedule.

For machines that will take each changing condition in stride . . . for machines that will give you immediate and continuous advantages, choose from the 1,872 different makes of machines that are REEVES-equipped for complete speed adjustability. Send for copy of 96-page Catalog M-450.

VARIABLE SPEED TRANSMISSION for infinite speed adjustibility over wide range of speed ratios, 2:1 through 16:1 and in sizes to 87 h.p.

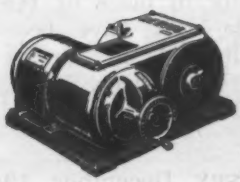


VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive. Sizes to 15 h.p. Speed variation within 4:1.

Accurate Variable

REEVES Speed Control

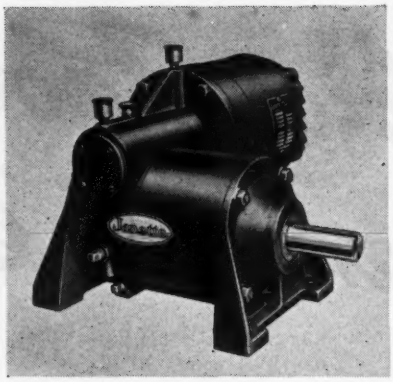
Gives the Right Speed for Every Job!



MOTODRIVE combines motor, speed varying mechanism, reduction gears in one compact unit. Sizes to 15 h.p. Speed variation 2:1 through to 6:1.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

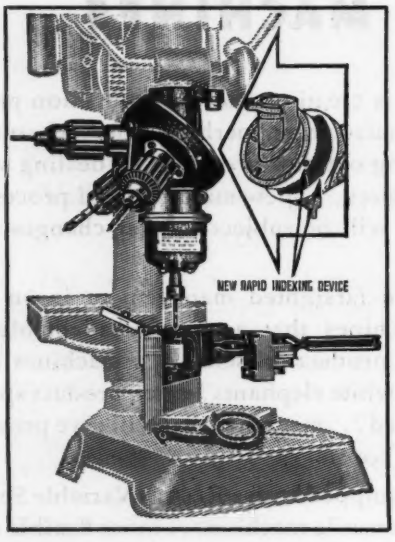
ing current, and through an electric controller, runs a direct-current motor at speeds which are infinitely variable within the speed and load capacity of the motor. The drive maintains a uniform torque over the entire speed range, and eliminates the changing of gears required in operating mechanical drives. It can be arranged for instantaneous dynamic braking and instant reversal without overrun. 109



Speed Reducer with Double Planetary Gear Unit Made by Janette Mfg. Co.

are available in either the motorless or motorized type.

Motors from 1/8 to 1/4 H.P. are used with this equipment, and output speeds as slow as 1.89 R.P.M. can be obtained. As illustrated, the slow-speed countershaft extends through the gear-box, supporting the worm-gear and both planetary units. The planetary gear units can be assembled on either side of the speed reducer. The speed reducer base is available with either foot or flange-base mounting. 111



"Quadrill" Four-way Turret Attachment Equipped with New Indexing Device

"Quadrill" Equipped with Indexing Device

The Chicago Drillet Corporation, 920 S. Michigan Ave., Chicago 5, Ill., manufacturer of the "Quadrill" four-way turret attachment for drill presses previously described in MACHINERY, has announced a major improvement in the method of indexing the turret of this equipment. The new device is designed to provide a simple positive means by which an inexperienced operator can quickly index the turret without danger of error. It has a unique positive quick-locking action that greatly simplifies indexing. 110

Janette Speed Reducers

Speed reducers with double planetary gear units in place of the standard single unit have been added to the line of the Janette Mfg. Co., 556 W. Monroe Street, Chicago 6, Ill. These speed reducers

Opti-Locator and Datum Block

Two new instruments developed to simplify the solution of work-centering problems have recently been announced by the Benton Co., 351 S. La Brea Ave., Los Angeles 36, Calif. The Opti-Locator shown in Fig. 1, is designed for use in centering and measuring operations on all types of machine tools. It is adapted for locating lay-outs, work edges, lines, or punch marks in line with any revolving spindle axis; measuring die cavities or checking dimensions that are inaccessible to mechanical measuring devices; accurately aligning a rotary table axis with the axis of the machine spindle; centering a spindle axis between opposing faces of a V-block for machining circular stock; locating centers of holes from which measurements are to be taken, etc.

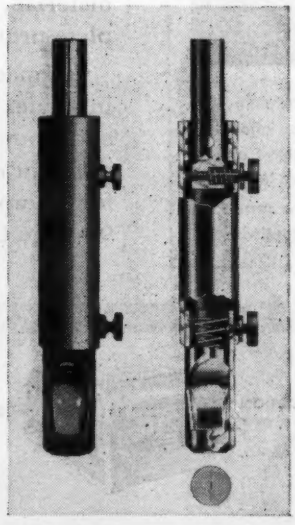


Fig. 1. Opti-Locator for Centering and Measuring Operations on Machine Tools

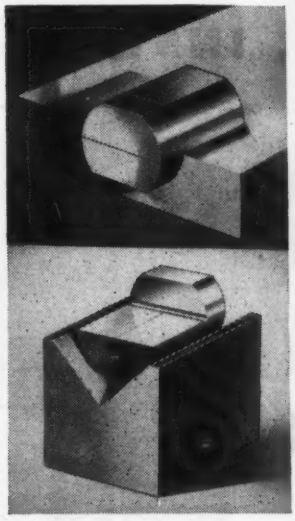
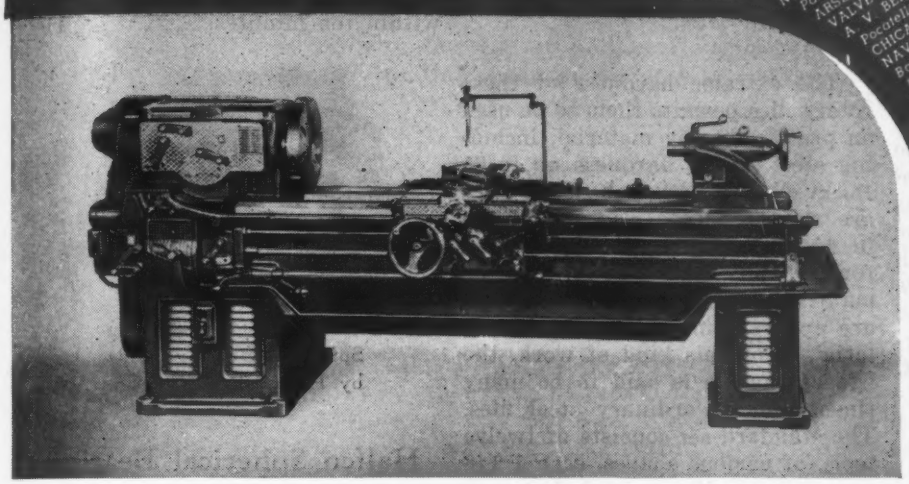


Fig. 2. Datum Block Developed for Use with the Opti-Locator

Scribed lines, prick-punch marks, or other marks on the work are enlarged by and viewed through the lenses of the instrument. These lenses are clamped in place by spring pressure on the upper prism faces, as indicated in the view to the right in Fig. 1. Images are reflected from the prism and are viewed from the side at a normal reading distance. The effect is the same as sighting a magnified image of the work through the exact center of the spindle. The large optical windows permit the instrument to be used under average room lighting conditions, but an auxiliary light can be directed to either or both optical windows. Accurate centering to within 0.0001 inch is readily obtained. The Opti-Locator is approximately 5 inches long by 7/8 inch in diameter, and can be conveniently carried in any tool kit.

To obtain additional information on equipment described on this page, see lower part of page 238.



SIDNEY *16×72 inch* HERRINGBONE GEARED LATHE

● Here is a highly developed machine with power and rigidity to take heavy cuts with alloy tipped tools yet sensitive enough for chasing threads and taking fine finishing cuts.

The continuous tooth Herringbone geared head developed by Sidney provides a smooth flow of power to the spindle with no thrust loads. Both the spindle and intermediate shaft are supported by center bearings in addition to the conventional end bearings.

It is this care of design and construction of Sidney Lathes that enables them to maintain accurate—high speed production over long periods.

There's a size and type available to meet your lathe requirements. Also bulletins on all sizes are at your disposal.

SIDNEY

The SIDNEY MACHINE TOOL Company

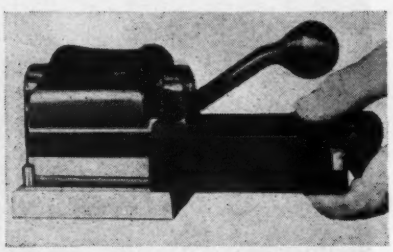
Builders of Precision Machinery

SIDNEY ESTABLISHED 1904 OHIO

The Datum Block, illustrated in Fig. 2, was designed to increase the utility of the Opti-Locator. It provides hair-lines by which the Opti-Locator can be aligned with any finished edge. It also centers V-blocks and similar fixtures with a spindle for machining surplus stock, and can be applied with gage-blocks for simplifying a variety of inspection work. ——— 112

Bakewell Quick-Clamping Tool-Holder

A tool-holder designed for quick positive clamping of a tool or cutter in such a manner that it can be repeatedly released and reclamped in exactly the same position has been placed on the market by the Bakewell Products Co. 2429 E. 14th St., Los Angeles 21, Calif. This holder was originally developed by the manufacturer for close-tolerance lathe work in his own plant.

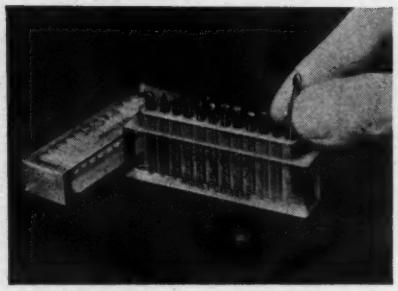


Quick-clamping Tool-holder Made by Bakewell Products Co.

It consists essentially of a quick-acting vise which can be easily mounted on the compound rest of a lathe without requiring any machining operations. The tool-bit holding bars are positioned against a positive stop in the tool-holder, and are held in place on hardened surfaces which provide rigid three-plane support. The action of inserting the tool-bar serves to clear chips from the supporting surfaces of the vise, and thus prevents misalignment. ——— 113

Tungsten-Carbide Rotary Files

Rotary files of solid tungsten carbide are being manufactured in extremely small sizes by Lincoln Park Industries, Lincoln Park 25, Mich. These files, known as "Midget Carburs," are furnished in sets for tool-room, die shop, pattern shop, and general production use.

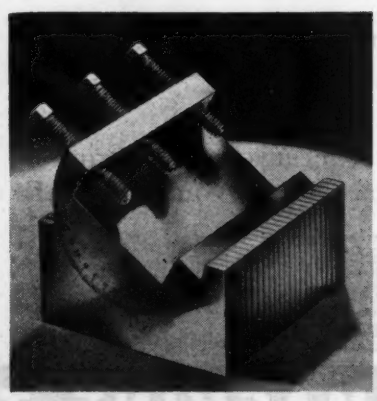


"Midget Carburs" Manufactured by Lincoln Park Industries

The extreme hardness of these rotary files permits them to be used on practically any material, including steel at any hardness up to 65 Rockwell C. Although these files are run at speeds of from 65,000 to 100,000 R.P.M., sharp corners, forms, and radii can always be maintained. The same advantages are apparent in cutting softer material. For this kind of work, the life of the file is said to be many times that of ordinary steel files. The standard set consists of twelve tools, of various shapes, each 1 1/8 inches long with a shank 1/8 inch in diameter, in a plastic case. ——— 114

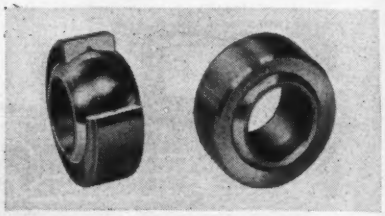
Parallel-Angle Magnetic Vise

A magnetic vise which can be set to any desired angle within accuracy limits of one minute of arc throughout a range of 180 degrees has been brought out in two sizes by the Lucas-Milhaupt Engineering Co., Cudahy, Wis. The vise insures longitudinal parallelism of the work within 0.0005 inch. It is magnetically held and clamped, and maintains parallelism in one plane while angular adjustments are made in a vertical plane.



Parallel-angle Magnetic Vise Made by Lucas-Milhaupt Engineering Co.

The base of the vise consists of copper and steel laminations that are permanently fused into a solid unit. In this base is a semicircular recess machined to receive the rotating work-holder. This arrangement permits the work-holder to be rotated through 180 degrees. Set-screws hold the object to be ground securely in the vise. In operation, the vise is set to the desired grinding angle by calibrations which permit vernier readings to within ten minutes. ——— 115



Two-piece Self-aligning Spherical Bearing Made by Halfco Products Co.

Halfco Spherical Bearing

The two-piece self-aligning spherical bearing made by the Halfco Products Co., 5341 San Fernando Road West, Los Angeles 26, Calif., which was previously used in army aircraft, is now being placed on the market for commercial use. The design of this bearing provides high load capacities, permits a high degree of misalignment, and results in a larger projected bearing area than previous designs. It is made with a one-piece bronze outer race into which is inserted under pressure a hard chromium-plated steel ball ——— 116

* * *

A liberal depreciation policy on the part of the Government would stimulate the buying of up-to-date manufacturing equipment. The building of this equipment would provide more jobs; the goods made on these machines would be produced cheaper and sold at a reduced price. This would stimulate sales and call for more production and more employment. Stifling the manufacturing industries, as to a great extent our methods of taxation do, does not make for increased employment. Our law-makers should realize that some methods of taxation tend to kill the goose that lays the golden egg.

To obtain additional information on equipment described on this page, see lower part of page 238.

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 237 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the December, 1945, Number of MACHINERY

Synthetic Rubber Molded Parts

AERO-SEAL RUBBER PRODUCTS DIVISION OF THE CHICAGO BELTING CO., 113 N. Green St., Chicago 7, Ill. 32-page book showing numerous examples of mechanical parts molded from synthetic rubber. Copies will be sent if requested on a company letter-head.

Friction Sawing

DOALL CO., 1301 Washington Ave., S., Minneapolis 4, Minn. Booklet entitled "Friction Sawing," describing this process and DoAll Zephyr high-speed sawing machines; includes a "Job Selector" chart to aid in selecting the proper saw pitch and velocity for cutting various types of materials of different thicknesses. ——— 1

Wire-Mesh Baskets

LUDLOW-SAYLOR WIRE CO., Newstead Ave. and Wabash Railroad, St. Louis 10, Mo. Circular illustrating and describing precision wire-cloth baskets and trays for handling work in such processes as annealing, brazing, carburizing, hardening, quenching, etc. ——— 2

Engineers' Glass and Lay-Out Scale for Form Grinders

ENGINEERS SPECIALTIES DIVISION OF UNIVERSAL ENGRAVING & COLORPLATE CO., INC., 980 Ellicott St., Buffalo 8, N. Y. Bulletin descriptive of detail engineers' glass and universal lay-out scale for form grinders, with 50 to 1 magnification. ——— 3

Lubrication Service Handbook

LUBRIPLATE DIVISION OF FISKE BROTHERS REFINING CO., Newark 5, N. J. Bulletin entitled "The Lubriplate Film," describing the characteristics of Lubriplate lubricants and containing recommendations for selecting the most suitable type for various classes of service. ——— 4

Electric Feedrail

FEEDRAIL CORPORATION, 125 Barclay St., New York 7, N. Y. Bulletin 17, descriptive of the electric Feedrail, a system of enclosed rails and trolleys for portable motors, lights, and other moving equipment, applicable to machine tools, cranes, etc. ——— 5

Coatings Made of Bakelite Resins

BAKELITE CORPORATION, UNIT OF UNION CARBIDE AND CARBON CORPORATION, 30 E. 42nd St., New York 17, N. Y. Booklet entitled "Modern Coatings Based on Bakelite Resins," outlining properties and possibilities of these coatings. ——— 6

"Gruv-Seal" Ring Gaskets

STEEL IMPROVEMENT & FORGE CO., 978 E. 64th St., Cleveland, Ohio. Booklet giving complete information and buying data on "Gruv-Seal" forged gaskets made of ingot iron, nickel, chromium, and Monel metal. ——— 7

Air and Hydraulic Cylinders

MILLER MOTOR CO., 4027-33 N. Kedzie Ave., Chicago 18, Ill. Bulletin A-103 and H-104, descriptive of a new line of 200-pound pressure air cylinders and 1500-pound pressure hydraulic cylinders, respectively. ——— 8

Vibration Test Machines

GLOBE INDUSTRIES, INC., 125 Sunrise Place, Dayton 7, Ohio. Bulletin V-1, illustrating and describing Globe "Vibrok" vibration and rocker test machines for heavy-weight aircraft parts and other industrial products. ——— 9

Grinding-Speed Calculator

ELECTRO REFRACTORIES & ALLOYS CORPORATION, Buffalo 2, N. Y., is distributing a handy grinding-speed calculator for determining surface speed in feet per minute for wheels of different diameters operating at various R.P.M. ——— 10

Precision Boring Machine

KEARNEY & TRECKER PRODUCTS CORPORATION, a subsidiary of KEARNEY & TRECKER CORPORATION, Milwaukee 14, Wis. Catalogue CMA 10, on the new Model C Milwaukee "Autometric" boring machine. ——— 11

Drilling and Tapping Machines

BARNES DRILL CO., 814 Chestnut St., Rockford, Ill. Condensed catalogue covering "Barnesdril" self-oiling all-geared drilling and tapping machines, hydraulic drilling units, hydraulic honing machines, and coolant separators. ——— 12

Universal Gear Grinders

GEAR GRINDING MACHINE CO., 3901 Christopher Ave., Detroit 11, Mich. Circular descriptive of the Geargrind universal oscillating chucking grinder; includes drawings showing typical examples of work. ——— 13

Plastics

WATERTOWN MFG. CO., Echo Lake Road, Watertown, Conn. Publication entitled "The Watertown Book of Plastics," describing this

LEADERSHIP

PROVED BY HUNDREDS OF CASE HISTORIES... ...

PLANNED PRODUCTION BECOMES EASIER WITH NEW BRITAINS

The built-in accuracy of New Britain Automatics assists many a manufacturer to plan peacetime production... helping skilled workmen to meet scheduled production at lowered costs.

For thirty years New Britain has been engineering, designing and producing multiple spindle bar and chucking machines that were ahead of the industry's demands for greater accuracy, higher speed and easier operation. This advanced engineering approach has been responsible for the production achievements New Britains have compiled during two wars and the times of peace that followed.

Many case histories, such as the one featured here, demonstrate the versatility of New Britains at work... forecast their productive value in the years ahead.

Consult a New Britain sales engineer. Let him prove that New Britains produce more... better and faster ...and that they belong in your planned production.

Let us be on the alert to recognize this honorable discharge button of World War II. Its wearer has earned our deepest gratitude and is deserving of the best we have to give him.

NEW BRITAIN AUTOMATICS

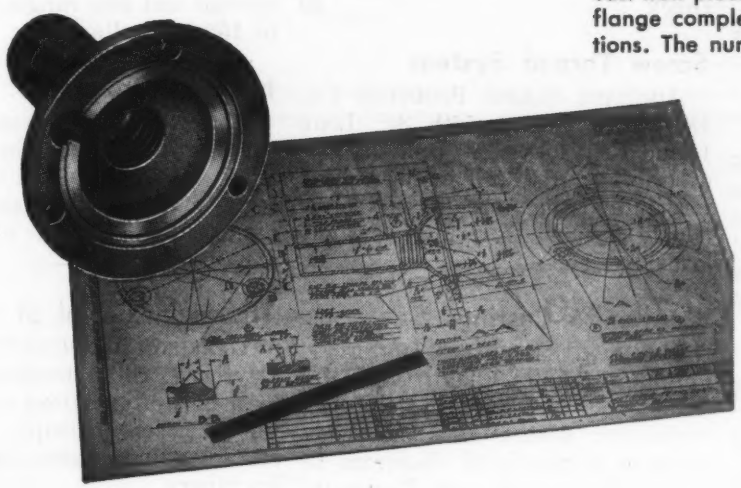
THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY DIVISION

...HERE'S ANOTHER

A typical case history is the Main Drive Gear Bearing Retainer pictured here . . . The number of cuts required, the need for economy of operation and speed of production, with rejects held to a minimum, posed a problem which was solved by the selection of a New Britain Model 675, 6 Spindle Automatic Chucking Machine.

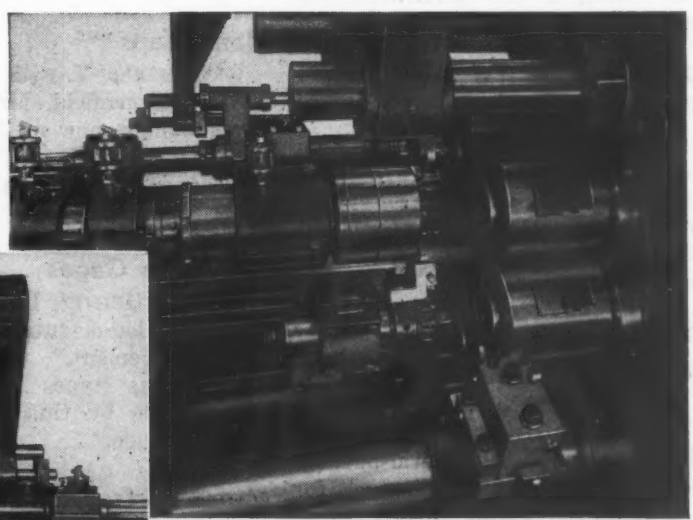
The first problem was to place tools so that this cast iron piece could be loaded and the bore and flange completely machined in the first four stations. The number five station carried a multiple drill head that machined the three holes in the flange at one time. The sixth station carried a collapsing tap for putting in oil grooves. This right hand spiral groove was 3/32" wide and 1/16" deep, and had to be held concentric with the bored and turned diameters within .002 total indicator reading. Sixteen operations in all, performed in 15 seconds, with gross production of 240 pieces per hour.

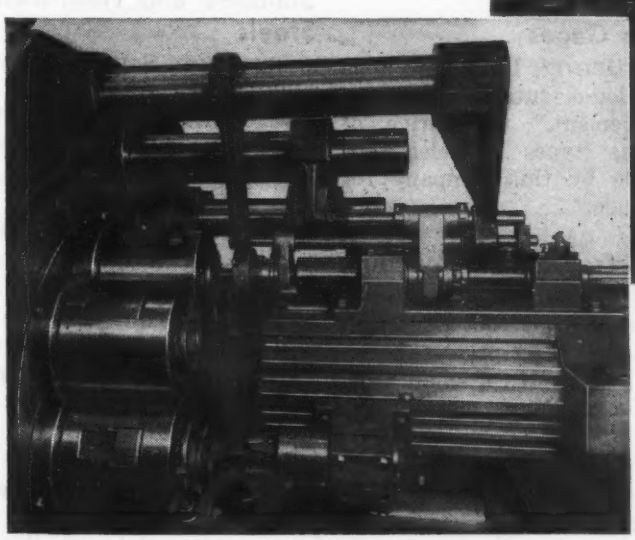
This is another case where the versatility and advanced engineering of New Britain Automatics solved a difficult problem.



FRONT VIEW

Entirely open end construction provides accessibility for simplified chucking, cutting tool and attachment set-up.





REAR VIEW

Wide open end construction provides extra large chip space . . . accessibility from three sides and from above that permits excellent visability and easy tool adjustment.

M-01018

The New Britain machine line includes four, six and eight multiple spindle automatic bar machines up to 2¼" capacity. Also a wide range of four, six and eight multiple spindle automatic chucking machines up to 12" capacity.

company's line of plastics, as well as molding methods and applications. 14

Heat-Stable, Waterproof Compounds

DOW CORNING CORPORATION, Midland, Mich. Bulletin covering a new line of silicone heat-stable, waterproof products, including compounds and greases, fluids, varnishes, silicone rubber, etc. 15

Glossary of Forging Machine Shop Terms

KROPP FORGE CO., 5301 W. Roosevelt Road, Chicago 50, Ill., is distributing without charge a glossary of forging machine shop terms and definitions to aid buyers and users of machined forgings. 16

Metal Stamping Service

DAYTON ROGERS MFG. CO., 2835 Twelfth Ave., S., Minneapolis 7, Minn. Folder outlining a metal stamping service for producing metal stampings in small lots; typical examples are illustrated, and costs are included. 17

Powdered Metal and Plastic Products

HUNGERFORD RESEARCH CORPORATION, Murray Hill, N. J. Booklet explaining the company's services in the development of new and improved products from powdered metals and plastics. 18

Positioner for Filing and Welding

U.D.A. Co., 3201 Vista, St. Louis 4, Mo. Leaflet showing applications of the U.D.A. general-purpose positioner—a new basic tool for use in filing, fitting, and welding operations. 19

Melting Furnaces for Non-Ferrous Metals

AJAX ELECTROTHERMIC CORPORATION, Trenton 5, N. J. Bulletin 26, describing the high-speed precision melting of non-ferrous metals in Ajax-Northrup induction furnaces. 20

Shock Absorption and Vibration Dampening

SPONGE RUBBER PRODUCTS CO., 216 Derby Place, Shelton, Conn. Bulletin on cellular rubber for shock absorption, vibration dampening, insulation, and other purposes. 21

Boring Chuck

DE SOTO TOOL CO., 16 Sproat, Detroit 1, Mich. Catalogue describing a new boring chuck by means of which it is possible to center-drill a hole, bore a hole, and drill again without removing the chuck. 22

Screw Thread System

AIRCRAFT SCREW PRODUCTS CO., INC., 47-23 Thirty-fifth St., Long Island City 1, N. Y. Bulletin 239, describing Heli-Coil screw-thread inserts and the Aero-Thread screw thread system for high fatigue loads. 23

Meehanite Castings

MEEHANITE RESEARCH INSTITUTE, Pershing Square Bldg., New Rochelle, N. Y. Bulletin DM-345, containing design data and comparative stress-strain diagrams of a low-carbon steel and Meehanite steel. 24

Hand Taps

GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass. Circular announcing a new method of packaging Greenfield taps which employs a color identification for the different types. 25

Electronic Gages

JACK & HEINTZ, INC., Cleveland, Ohio. Catalogue entitled "Miracles of Measurement," descriptive of the various types of electronic gages made by this company for industrial use. 26

Metal Parts Cleaning Machine

MAGNUS CHEMICAL CO., Equipment Division, Garwood, N. J. Bulletin 200-AJ, descriptive of the Magnus Aja-Dip, Jr., a small sized machine for cleaning metal parts in production. 27

Tachometers

HERMAN H. STICHT CO., INC., 27 Park Place, New York 7, N. Y. Bulletin 750, describing the new Standco universal type hand tachometer for measuring speeds between 30 and 48,000 R.P.M. 28

Milling Safeguards

ROLL AWAY SKATE CO., 4533 Payne Ave., Cleveland, Ohio. Circular illustrating and describing Rol-O-Way cutter guards for milling machines, made in sizes suitable for all machines. 29

Electric Test Sets

GENERAL ELECTRIC CO., Schenectady 5, N. Y. Bulletin GEA-4477, containing data on the GE complete line of portable alternating-current test sets ranging from 2000 to 150,000 volts. 30

Norbide Products

NORTON CO., Worcester 6, Mass. Circular describing the characteristics of Norbide—the hardest material made—and its application in gages, dies, anvils, nozzles, and abrasives. 31

Thermal Control of Machines

GARRISON MACHINE WORKS, INC., Dayton 7, Ohio. Booklet outlining, by means of questions and answers, the Garrison principle of thermal control of machine tools and other machinery. 32

Mechanical Conveyors

STANDARD CONVEYOR CO., North St. Paul 9, Minn. Bulletin 66, showing forty-one installations of conveying equipment in machine shops, airplane plants, steel mills, foundries, etc. 33

Stainless and Heat-Resistant Steels

REPUBLIC STEEL CORPORATION, 3100 E. 45th St., Cleveland 4, Ohio. Booklet ADV 430, "In War—in Peace, Republic Enduro Stainless and Heat-Resisting Steels." 34

Hydraulic Pumping Unit

SUNDSTRAND MACHINE TOOL CO., 2530 Eleventh St., Rockford, Ill. Bulletin descriptive of the operating principles and applications of the Sundstrand hydraulic pumping unit. 35

Chucks

SKINNER CHUCK CO., New Britain, Conn. Catalogue 58, containing complete data on the line of hand- and power-operated chucks and machine vises made by this company. 36

Hydraulic Portable Spot-Welders

SCIAKY BROS., 4915 W. 67th St., Chicago 38, Ill. Bulletin 122-A,

g
ll-
t-
29

INDUCTION MOTOR "TROUBLE-SHOOTING" CHART—1

Trouble	Cause	Remedy
Motor will not start	Overload control trip	Wait for overload to cool. Try starting again. If motor still does not start, check all causes as outlined below.
	Power not connected	Connect power to control and control to motor. Check clip contacts.
	Faulty (open) fuses	Test fuses.
	Low voltage	Check motor-nameplate values with power supply. Also check voltage at motor terminals with motor under load to be sure wire size is adequate.
	Wrong control connections	Check connections with control wiring diagram.
	Loose terminal-lead connection	Tighten connections.
	Driven machine locked	Disconnect motor from load. If motor starts satisfactorily, check driven machine.
	Open circuit in stator or rotor winding	Check for open circuits.
	Short circuit in stator winding	Check for shorted coil.
	Winding grounded	Test for grounded winding.
	Bearings stiff	Free bearings or replace.
	Grease too stiff	Use special lubricant for special conditions.
	Overload	Reduce load.
Motor noisy	Motor running single phase	Stop motor, then try to start. It will not start on single phase. Check for "open" in one of the lines or circuits.
	Electrical load unbalanced	Check current balance.
	Shaft bumping (sleeve-bearing motors)	Check alignment, and condition of belt. On pedestal-mounted bearing, check cord play and axial centering of rotor.

MACHINERY'S Data Sheet No. 551, December, 1945 Compiled by the General Electric Co. Schenectady, N. Y.

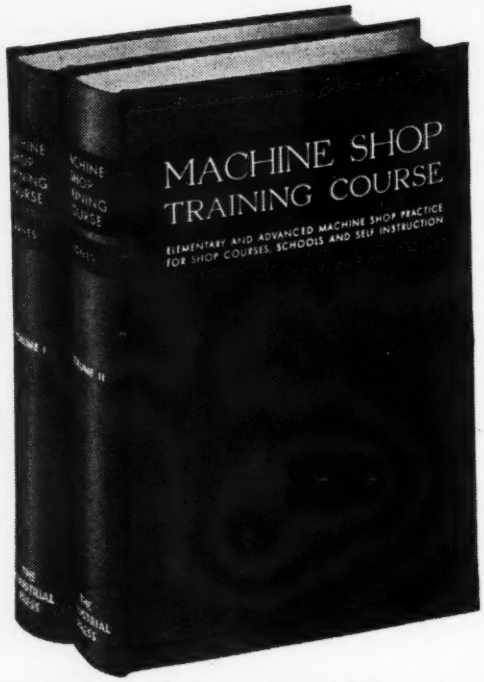
INDUCTION MOTOR "TROUBLE-SHOOTING" CHART—2

Trouble	Cause	Remedy
Motor noisy (cont.)	Vibration	Driven machine may be unbalanced. Remove motor from load. If motor is still noisy, rebalance rotor.
	Air gap not uniform	Center the rotor, and if necessary, replace bearings.
	Noisy ball bearings	Check lubrication. Replace bearings if noise is persistent and excessive.
	Loose punchings or loose rotor on shaft	Tighten all holding bolts.
	Rotor rubbing on stator	Center the rotor, and replace bearings if necessary.
	Objects caught between fan and end shields	Disassemble motor and clean it. Any rubbish around motor should be removed.
	Motor loose on foundation	Tighten hold-down bolts. Motor may have to be realigned.
	Coupling loose	Insert feelers at four places in coupling joint before pulling up bolts to check alignment. Tighten coupling bolts securely.
Running at higher than normal temperature or smoking	Overload	Measure motor loading with ammeter. Reduce load.
	Electrical load unbalanced	Check for voltage unbalance or single phasing.
	Fuse blown, faulty control	Check for "open" in one of the lines or circuits.
	Restricted ventilation	Clean air passages and windings.
	Incorrect voltage and frequency	Check motor-nameplate values with power supply. Also check voltage at motor terminals with motor under full load.
	Motor stalled by driven machine or by tight bearings	Remove power from motor. Check machine for cause of stalling.
	Rotor winding with loose connections	Tighten, if possible, or replace with another rotor.
	Belt too tight	Remove excessive pressure on bearings.
	Motor used for rapid reversing service	Replace with motor designed for this service.

MACHINERY'S Data Sheet No. 552, December, 1945 Compiled by the General Electric Co. Schenectady, N. Y.

Machine Shop Training Course

WITH BLUEPRINT READING CHARTS


MACHINE SHOP
TRAINING COURSE
ELEMENTARY AND ADVANCED MACHINE SHOP PRACTICE
FOR SHOP COURSES, SCHOOLS AND SELF INSTRUCTION

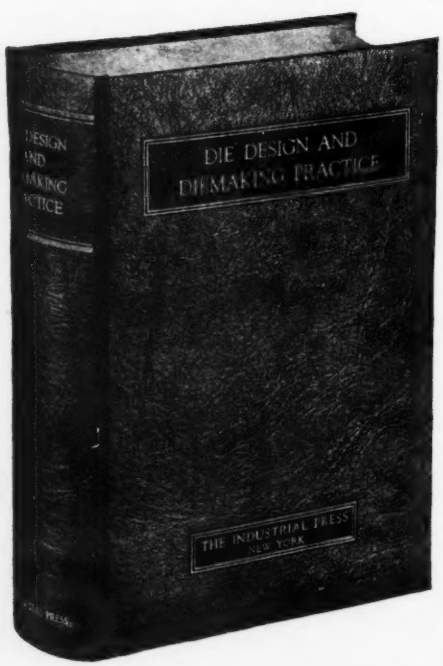
This standard treatise on machine shop practice in two volumes is for the shop man who wants to supplement his own experience with a broad fund of practical knowledge; for use as a textbook and guide in shop training courses; for technical or trade schools; for designers who want the fundamentals of machine shop practice; for mechanical engineering students.

The MACHINE SHOP TRAINING COURSE contains over 1100 pages of questions and answers. These questions deal with the elements of machine shop practice and other subjects closely allied to the work of the shop. The answers are packed with useful facts, shop rules, typical shop problems and their solutions. 524 drawings and photographs illustrate all kinds of machining operations, cutting tools, gages, etc.

Price $6 Set—Payable $2 with Order, $2 Monthly

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Die Design and Diemaking Practice



If you design, make or use dies for blanking, forming or drawing sheet-metal parts, here is a veritable die designer's and diemaker's bible. This die book presents not only descriptions and drawings of a tremendous variety of dies, but a vast amount of data representing a lot of boiled down and costly die experience. Dies of the same general classes are grouped together in chapters. The drawing dies have been placed into chapters according to the general shapes of the parts produced, to facilitate finding the type of die for producing a given shape. Price $6—payable if desired $2 with order and $2 monthly for two months.

956 pages, 590 illustrations

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

describing the OWH series hydraulically operated portable spot-welders. ____ 37

Diamond Wheels

COLDSET DIAMOND TOOL CO., INC., 2160 N. Hoyt Ave., Fort Lee, N. J. Bulletin and price lists covering Coldset diamond wheels, dressers, and other diamond products. ____ 38

Plastics Primer

DUREZ PLASTICS & CHEMICALS, INC., 5811 Walck Road, North Tonawanda, N. Y. Booklet entitled "Plastics Primer," presenting essential facts for the layman on phenolic plastics. ____ 39

Lock-Nuts

FAULTLESS CASTER CORPORATION, Lock-Nut Division, Evansville, Ind. Circular on the Klincher lock-nut, a one-piece metal lock-nut with patented cone grip for quick, permanent application. ____ 40

Ball Reciprocating Bearings

TORRINGTON CO., Bantam Bearings Division, South Bend 21, Ind. Bulletin 105, containing data on high-capacity ball reciprocating bearings. ____ 41

Cone Drive in Machine Tools

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit 12, Mich. Bulletin 632, discussing design and application of cone-drive gearing in machine tools. ____ 42

Carbide-Tipped Tools

WILLEY'S CARBIDE TOOL CO., 1340 W. Vernor Highway, Detroit 1, Mich. Bulletin giving specifications for Willey's standard carbide-tipped tools and Willey's standard tool blanks. ____ 43

Milling Machine Arbors

CINCINNATI MILLING MACHINE CO., Cincinnati 9, Ohio. Publication M-1424, containing complete data on Cincinnati milling machine arbors and accessories. ____ 44

Flexible-Shaft Operating Gear

STOW MFG. CO., Binghamton, N. Y. Book 645C, containing data on the selection, installation, and use of flexible shafting for the remote control of valves. ____ 45

Phosphor-Bronze Weldrod

AMPCO METAL, INC., Milwaukee 4, Wis. Engineering Data Sheet No. 137, containing data on "Phos-Trode"—a new shielded-arc phosphor-bronze weldrod. ____ 46

Machine Tools

DELTA MFG. CO., 600 E. Vienna Ave., Milwaukee 1, Wis. Catalogue 14, covering the complete line of light machine tools made by this company. ____ 47

Precision Gages

AA GAGE CO., 350 Fair St., Detroit 20, Mich. Bulletin covering the line of precision gages made by this concern, including special built-up gages and fixtures. ____ 48

High-Speed Steel Tool Bits

VANADIUM-ALLOYS STEEL CO., Latrobe, Pa. Bulletin describing the company's complete line of high-speed steel tool bits and Lamite cutting tools. ____ 49

Seamless Tubing

TUBE REDUCING CORPORATION, Wallington, N. J. Circular describing the manufacture and characteristics of Rockrite close-tolerance, cold-reduced seamless tubing. ____ 50

Tachometers

METRON INSTRUMENT CO., 432 Lincoln St., Denver 9, Colo. Circular on electric hand tachometers for measuring either rotational or linear speeds. ____ 51

Cams and Tools

STITES TOOL CO., 1426 W. 3rd St., Cleveland 13, Ohio. Bulletin entitled "Now Maximize Your Machine Production with Cams and Tools by Stites." ____ 52

Carbon Electrode Holders

TWECO PRODUCTS CO., Wichita 7, Kan. Leaflet containing data on Tweco air-cooled carbon electrode holders for manual welding. ____ 53

Over-Running Clutches

GEAR GRINDING MACHINE CO., 3901 Christopher Ave., Detroit 11,

---

To Obtain Copies of New Trade Literature

listed on pages 231-238 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue to:

MACHINERY, 148 Lafayette St., New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

*Name*_____ *Position or Title*_____

[This service is for those in charge of shop and engineering work in manufacturing plants.]

*Firm*_____

*Business Address*_____

*City*_____ *State*_____

[SEE OTHER SIDE]

Mich. Circular illustrating and describing the Formsprag overrunning clutch. 54

Precision Lathes

HARDINGE BROTHERS, INC., Elmira, N. Y. Bulletin DV59, illustrating and describing the new Hardinge DV59 high-speed precision lathe. 55

Stainless Steels

JESSOP STEEL CO., Washington, Pa. Circular listing the physical properties and mechanical characteristics of Jessop stainless steels. 56

Hard-Facing Alloys

WALL COLMONOY CORPORATION, 720 Fisher Bldg., Detroit 2, Mich. Catalogue 76, giving data on properties, advantages, and typical uses of Colmonoy hard-facing alloys. 57

Automatic Indexing Base

SUNDSTRAND MACHINE TOOL CO., 2530 Eleventh St., Rockford, Ill. Bulletin 23, describing the Sundstrand automatic index base. 58

Cutting Electrodes

ELLWOOD PRODUCTS CORPORATION, Ellwood City, Pa. Bulletin descriptive of Ellpro electrodes for underwater or surface cutting. 59

Industrial Vacuum Cleaners

ALLEN BILLMYRE CO., 431 Fayette Ave., Mamaroneck, N. Y. Bulletin F-4, on Exidust portable industrial vacuum cleaners. 60

Vibration Testing Equipment

L. A. B. CORPORATION, 31 Union Place, Summit, N. J. Bulletin illustrating and describing the vibration test equipment made by this company. 61

Gas Welding and Cutting

AIR REDUCTION, 60 E. 42nd St., New York 17, N. Y. 16-page catalogue on gas welding and cutting supplies and accessories. 62

Wire-Stripping Machines

LEAD-ALL PRODUCTS CO., 24 E. 21st St., New York 10, N. Y. Bulletin 15, describing Model 100 wire-stripping machines. 63

Ampco Metal Gears

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Bulletin 55, illustrating and describing the use of Ampco metal in gear applications. 64

Radius Dressers

U. S. TOOL & MFG. CO., 6906 Kingsley Ave., Dearborn, Mich. Catalogue describing three models of radius dressers. 65

Quick-Acting Clamp

MECHANICS ENGINEERING CO., Jackson, Mich. Leaflet announcing a new C-clamp with quick-acting "Bar-lok." 66

Westinghouse Installs New High-Frequency Laboratory in the West

A new laboratory to which industrial concerns in the West may bring problems pertaining to high-frequency heating has been opened by the Westinghouse Electric Corporation in Los Angeles, Calif. Dr. Russell A. Nielsen, formerly of the company's Research Laboratories at East Pittsburgh, Pa., will be in charge of the new laboratory. Dr. Nielsen will be assisted by a staff of research engineers.

* * *

Metric Screw Thread Standards

Repeated inquiries from industrial concerns have led to the preparation of a review of the present status of metric screw thread standards. Those interested in this subject will find this review in the August number of *Industrial Standardization*, published by the American Standards Association, 70 E. 45th St., New York 17, N. Y. Copies of the national standards of most foreign countries are also available from the American Standards Association.

* * *

You cannot build character and courage by taking away a man's initiative and independence.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 199-230 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in December, 1945, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 196-197, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in December, 1945, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York 13, N. Y.

[SEE OTHER SIDE]

News of the Industry

California

J. L. QUISENBERRY has resigned his position as advertising manager with the Axelson Mfg. Co., Los Angeles 11, Calif. He plans to open an office in Huntington Park, where he will serve manufacturers in the preparation of catalogues, bulletins, and direct-mail campaigns, as well as in certain other phases of publicity and advertising promotion. L. F. LUTZ will succeed Mr. Quisenberry as advertising manager of the company.

RALPH E. MIDDLETON, a vice-president of the Aireon Mfg. Corporation, Kansas City, Kan., has been named general manager of the corporation's Hydraulic Division at Burbank, Calif. He has been chief engineer of that division since 1941.

WESTCRAFT MACHINE & ENGINEERING Co. announces that it has moved into its new offices and factory at 1461 Canal Ave., Long Beach 6, Calif.

Illinois

CARBOLOY COMPANY, INC., Detroit, Mich., in order to meet the rapidly expanding demand for carbide-tipped cutting tools in northern and central Illinois, northern Indiana, southern Wisconsin, southwestern Michigan, and the eastern part of Iowa, along the Mississippi River, has appointed SAMUEL HARRIS & Co., Chicago, Ill., distributor for that area. FRANK DAVIS has been appointed manager of the Carboloy cutting tool department of the Harris company, and GEORGE CARTWRIGHT service engineer.

CHARLES H. MORSE III has been elected vice-president of Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill. He will be in charge of research, patents, traffic, the Western Pump Division of the company, and the Inland Utilities Co. subsidiary. His headquarters will be in Chicago.

EDWARD M. WHITING has been elected president of the Pheoll Mfg. Co., Chicago, Ill., succeeding Mason Phelps, who died on September 2. Mr. Whiting has been vice-president since 1926, and a director since 1916.

G. S. SWANSON has been appointed sales manager of the Oscar W. Hedstrom Corporation, Chicago 51, Ill., following the resignation of CARL E. PAYNE, vice-president in charge of sales and advertising.

KEITH H. BLISS has been appointed sales engineer for the H. M. Harper Co., Chicago, Ill., manufacturer of "Everlasting" fastenings. He was formerly with the Powercraft Corporation, St. Louis, Mo.

FORSS PNEUMATIC TOOL Co. announces that it has moved from 1827 Broadway, Rockford, Ill., to new and larger quarters at 518 Hankes Ave., Aurora, Ill.

Indiana

TOCCO INDUCTION DIVISION OF THE OHIO CRANKSHAFT CO., Cleveland, Ohio, announces the opening of a sales-engineering office at 35 E. Georgia St., Indianapolis 4, Ind., with JAMES W. CALLOWAY in charge. Mr. Calloway was formerly connected with the Chicago office of the division.

C. L. ROBERTSON Co., 709 E. 38th St., Indianapolis 5, Ind., has been appointed exclusive sales representative in southern and central Indiana for the cylindrical die thread rollers and thread rolling dies made by the Rolled Thread Die Co., Worcester, Mass.

JOSEPH EDIE has been named branch manager at Indianapolis, Ind., of the Jessop Steel Co., Washington, Pa. He was formerly sales representative of the company in Cleveland, Ohio. His headquarters will be in the Architects and Builders Bldg., Indianapolis.

HAROLD J. THOMPSON has been appointed district manager of Reliance Electric & Engineering Co., Gary, Ind. He will serve the industries of the Calumet and northern Indiana districts, and will make his headquarters in the Gary National Bank Bldg.

K. G. BAKER has returned to the Wagner Electric Corporation, St. Louis, Mo., as a field engineer in the Indianapolis office after three years of active duty with the Army.

Maryland

BRIGGS CLARIFIER Co., Bethesda, Md., announces the appointment of the following distributors: CURTIS ENGINE & EQUIPMENT Co., 104 Light St., Baltimore, Md., marine products distributor for the Chesapeake Bay area; WEEKS ENGINEERING Co., 4526 Olive St., St. Louis, Mo., industrial oil filtration products distributor for eastern Missouri, part of southern Illinois, and part of southern Indiana; and EQUIPMENT SUPPLY Co., 60 Richards St., Salt Lake City 1, Utah, distributor for industrial oil filtration products in the state of Utah and in parts of Wyoming, Idaho, and Nevada.

BRIGGS CLARIFIER Co., manufacturer of specially engineered oil filtration equipment, has now centered all of its offices and laboratories at Bethesda, Md. By moving its offices to this new location, all of the company's activities are housed in its own buildings.

Michigan

LAYMAN WELDING SUPPLY Co., 215 Oakes St., S.W., Grand Rapids, Mich., is a new concern established by R. DUDLEY LAYMAN, formerly district manager and welding engineer of the Grand Rapids office of the Lincoln Electric Co., Cleveland, Ohio. This new concern will carry a complete stock of arc and gas welding and cutting materials and will offer a comprehensive service to users on the application of arc-welding methods and technique. Mr. Layman had been connected with the Lincoln Electric Co. for nineteen years. He will be replaced by I. R. BARTTER, who will have charge of the Grand Rapids office of the Lincoln Electric Co.

BARBER-COLMAN Co., Machine and Small Tool Divisions, Rockford, Ill., has appointed FRANZ HERBERT machine tool and small tool sales representative of the company throughout northern Indiana and western Michigan, with headquarters in Kalamazoo, Mich. Mr. Herbert, who has been with the company for many years, formerly served on the field engineering staff as a consultant on hobs, hobbing problems, and general milling machine problems.

BERT CARPENTER Co. has been organized to serve as machine tool distributor in the state of Michigan and northern Ohio, with headquarters at 208 Hanna Bldg., Birmingham, Mich. The company is at present representing the PLAN-O-MILL CORPORATION, Hazel Park, Mich., and RELIANCE HYDRAULIC PRESS, INC., of New York City. T. B. CARPENTER, formerly vice-president and sales manager of the Wickman Corporation, is head of the new concern.

KAYDON ENGINEERING CORPORATION, Muskegon, Mich., announces the following changes in its sales department: FRANK D. CLARK has been ap-

Now! LOCAL STOCKS OF CARBOLOY STANDARDS IN 45 CITIES FROM COAST TO COAST

TRADEMARK

In 45 cities—strategic centers of production—you'll find Carboloy Branch Offices or Authorized Distributors ready to fill your needs *fast* from *complete* stocks of Carboloy standard cemented carbide tools and blanks. Experience has shown that 60-80% of ALL your carbide requirements can be met out of the 300 sizes and styles of standards available. Call the nearest listed representative for prompt deliveries.

Call upon these men, too, for expert advice on carbide tool application or maintenance problems—they've been factory-trained to aid you.

And these fast, easy-to-apply carbides are accumulating an amazing history of diversified uses. Let Carboloy's representatives help get you the full benefit of *faster* output, *lower* production costs—throughout your plant—with Carboloy Cemented Carbides.

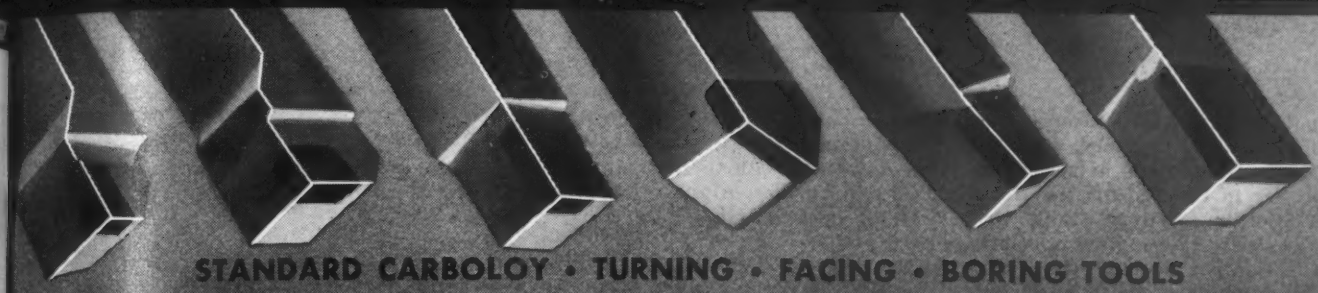
Ready to Serve You

AUTHORIZED CARBOLOY CEMENTED CARBIDES DISTRIBUTORS

AUTHORIZED DISTRIBUTOR LIST

Albany, N. Y. . . . . Sager-Spuck Supply Co.
Baltimore, Md. . . . The L. A. Benson Co., Inc.
Birmingham, Ala. . . . . Quinn & Quinn
Brooklyn, N. Y. . . . . A. N. Nelson, Inc.
Buffalo, N. Y. . . . . R. C. Neal Co., Inc.
Charleston, S. C.
The Cameron & Barkley Co.
Chicago, Illinois. { Samuel Harris & Co.
Screw Machine Supply Co.
Cincinnati, Ohio . . . . . The E. A. Kinsey Co.
Cleveland, Ohio
Strong, Carlisle & Hammond Co.
Columbus, Ohio . . . . . The E. A. Kinsey Co.
Dallas, Texas . Machinery Sales & Supply Co.
Denver, Col. . . The Mine & Smelter Supply Co.
*Detroit, Mich. . . { Sterling Supply Co.
The Chas. A. Strelinger Co.
El Paso, Texas
El Paso Saw & Belting Supply Co.
Honolulu, Hawaii, U.S.A.
W. A. Ramsay, Ltd.
*Houston, Texas . . . . . .
Jacksonville, Fla.
The Cameron & Barkley Co.
Kansas City, Mo.
Ellfeldt Machinery & Supply Co.
Knoxville, Tenn. . . . . The W. S. Murrian Co.
*Los Angeles, Calif. . . . . Garrett Supply Co.
Memphis, Tenn. . . . . J. E. Dilworth Co.
Miami, Fla. . . . . The Cameron & Barkley Co.
Minneapolis, Minn. . . . The John C. Eide Co.
Muskegon, Mich.
Muskegon Hardware & Supply Co.
New Orleans, La.
Murray-Baker-Frederic, Inc.
*Newark, N. J. . . . . General Carbides Co.
Norfolk, Va.
Empire Machinery & Supply Corp.
Oklahoma City, Okla.
Marshall Supply & Equipment Co.
Omaha, Nebr. . Fuchs Machinery & Supply Co.
Pittsburgh, Pa. . . . Harris Pump & Supply Co.
Portland, Ore. . . . . J. E. Haseltine & Co.
St. Louis, Mo. . . . . Sligo Iron Store Co.
Salt Lake City, Utah
The Mine & Smelter Supply Co.
Savannah, Ga. . . The Cameron & Barkley Co.
Seattle, Wash. . . . . J. E. Haseltine & Co.
South Bend, Indiana . South Bend Supply Co.
Syracuse, N. Y. . . . . Syracuse Supply Co.
Tampa, Fla. . . . . The Cameron & Barkley Co.
Toledo, Ohio . . . . . Mill & Factory Supply Co.
Tulsa, Okla.
Marshall Supply & Equipment Co.
Waterbury, Conn. . . . . The White Supply Co.
Waterville, Me. . . . . Harold W. Kimball Co.
Wichita, Kan.
White Star Machinery & Supply Co.
Williamsport, Pa. . . . Lowry Electric Co.
Winston-Salem, N. C. . . . . Atlas Supply Co.

*STOCKS ALSO MAINTAINED AT FOLLOWING HEADQUARTERS OFFICES OF CARBOLOY COMPANY, INC.:
Detroit, Michigan • Houston, Texas • Los Angeles, California • Newark, New Jersey



STANDARD CARBOLOY • TURNING • FACING • BORING TOOLS

BLANKS

FOR GENERAL USE

POINTED NOSE

FOR SCRAPERS

FOR REAMERS

BUSHINGS FOR GAGES AND GENERAL USE

FOR TWIST DRILLS

NERAL USE

CUT-OFF TOOLS

GROOVING TOOLS

LATHE AND GRINDER CENTERS

BORING TOOLS

WEAR-RESISTANT GUIDE RINGS

TURNER TOOLS

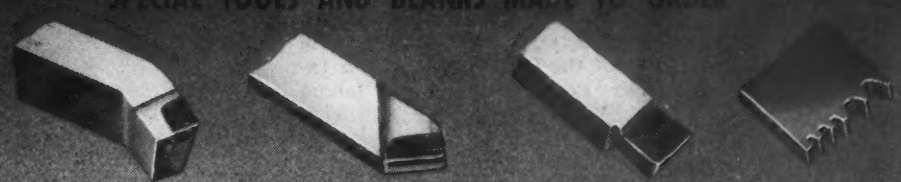
Adaptable to 60%-80% of Your TURNING, BORING, FACING OPERATIONS

SHEAR TYPE NEG. RAKE TOOLS

GRINDING WHEEL DRESSERS

MASONRY DRILLS

SPECIAL TOOLS AND BLANKS MADE TO ORDER



Order to Meet Your Carboloy Requirements from Catalog G.T.-175R

CARBOLOY COMPANY, INC. • 11177 E. 8 MILE ROAD • DETROIT 32, MICHIGAN

CHICAGO • CLEVELAND • HOUSTON • LOS ANGELES • MILWAUKEE • NEWARK • PHILADELPHIA • PITTSBURGH • THOMASTON

ALSO SOLD BY LEADING MILL SUPPLY DISTRIBUTORS

CARBOLOY TRADEMARK

CEMENTED CARBIDES

pointed district engineer in Cleveland for the Ohio territory, and CLAUDE C. CROSIER has been named district engineer in Chicago for the Illinois and Wisconsin territory. Both Mr. Clark and Mr. Crosier were formerly with the Bantam Bearings Division of the Torrington Co., South Bend, Ind.

DONALD L. SCHWARTZ, who until two years ago was superintendent of the metallurgical laboratory of the Cleveland Graphite Bronze Co., has joined the Carboloy Company, Inc., Detroit, Mich., in the capacity of research metallurgist. For the last two years Mr. Schwartz has been engaged in war research work at the metallurgical laboratory of the University of Chicago.

D. A. NABB has joined the sales staff of the Detroit Seamless Steel Tubes Co., Detroit 8, Mich. Mr. Nabb was a major attached to the office of the Chief of Ordnance at Washington, D. C., during the war, and has just received his discharge. Prior to entering the armed services, he was with the Ford Motor Co., Detroit, Mich., in the production department.

PLAN-O-MILL CORPORATION, 1511 E. Eight Mile Road, Hazel Park, Mich., manufacturer of planetary milling machines and milling cutters, announces the appointment of the BERT CARPENTER CO., Birmingham, Mich., as sales representative for the company's line of machine tools in Michigan and northern Ohio.

RUTLAND TOOL SERVICE, 13006 Greeley St., Detroit, Mich., is reconditioning cutting tools with a new type of grinding equipment that permits the recutting of end-mills, side-mills, drills, etc. The tools reconditioned in this way adhere to the original spirals and tool standards.

LARRY S. ANDRICH has been made vice-president and general manager of the Snyder Tool & Engineering Co., Detroit, Mich. GEORGE H. WHITEHOUSE becomes sales manager; WILLIAM C. OBEREM, chief engineer; and JOHN F. BENNER, assistant chief engineer.

RAY P. JOHNSON has been appointed assistant to the general manager of the Morse Chain Co., division of the Borg-Warner Corporation, Detroit, Mich. He returns to the company after more than three years' service in the Army Ordnance Department.

JOHN D. GORDON has been advanced from the post of general sales manager to that of general manager of the Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich. CARL L. HALPIN has been appointed manufacturing works manager.

RALPH G. LAGERFELDT has been elected vice-president, and FRANCIS E. PETHICK treasurer, of the Colonial Broach Co., Detroit, Mich. Mr. Lagerfeldt, who has been with the company for fifteen years, will continue to have charge of all sales activities.

DEFENSE TOOL & GAUGE CO. announces that the name of the company has been changed to DELCO TOOL MFG. CO. and that the company has moved from 1245 E. Eight Mile Road, Hazel Park, Mich., to 2160 Hendricks St., Detroit 7, Mich.

LIEUTENANT-COMMANDER PAUL R. WARMEE has returned to the Pontiac Motor Division of General Motors Corporation, Pontiac, Mich., to take the newly created post of advertising and sales promotion manager.

LEAR, INC., announces that the general offices of the company are now located at 110 Ionia Ave., N. W., Grand Rapids 2, Mich.

Missouri

J. D. EBY, manager of purchases for the Wagner Electric Corporation, St. Louis 14, Mo., has been elected secretary of the company, filling the vacancy created by the death of J. W. Westcott. Mr. Eby will retain his duties as manager of purchases.

CARBOLOY COMPANY, INC., Detroit, Mich., has appointed the SLIGO IRON STORE CO., St. Louis, Mo., distributor in southern Illinois and eastern Missouri for the carbide-tipped cutting tools made by the company. J. J. DEMUTH is in charge of this activity.

New England

W. S. ROCKWELL CO., announces that the general headquarters of the company are now located at 200 Eliot St., Fairfield, Conn. This change in location has been made to consolidate the activities of the Rockwell Furnace Division, the Rockwell Valve Division and the Gehnrich Oven Division of the company, and to provide enlarged engineering and plant facilities and services. The New York sales engineering office at 50 Church St., New York 7, N. Y., will be retained.

AMERICAN CHAIN & CABLE CO., INC., Bridgeport 2, Conn., has acquired the business of the CERTIFIED GAUGE & INSTRUMENT CORPORATION, Long Island City, N. Y. Manufacturing will continue at the Long Island City plant under the name Helicoid Gage Division, American Chain & Cable Co., Inc.

DONALD MCCLAIN, of Manchester, Conn., has been appointed representative in the New England area for the Aircraft Screw Products Co., Inc., Long Island City, N. Y.

Wallace L. Pond, Director of Sales of Nicholson File Co., Who is Retiring after Fifty Years' Service

WALLACE L. POND, director of sales of the Nicholson File Co., Providence, R. I., has retired after fifty years of service with the company, and is succeeded by HARRY L. WHITNEY. Mr. Whitney served two and a half years in Washington as assistant lend-lease administrator and as director of certain policies in the foreign economic administration. He has had wide experience in sales management with the U. S. Rubber Co. and the Borg-Warner Corporation. JOHN COLLIER continues as sales manager.

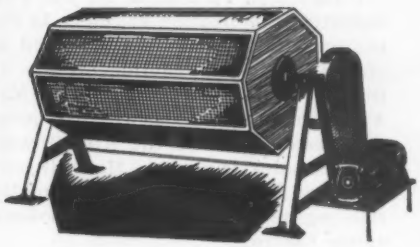
WILLIAM L. BURGOYNE has been appointed special field engineer for the

Harry L. Whitney, Who Succeeds Mr. Pond as Director of Sales of Nicholson File Co.

MACHINING DATA ON PLASTICS

6. TUMBLE SCREENING

(PART ONE OF TWO PARTS ON TUMBLING)

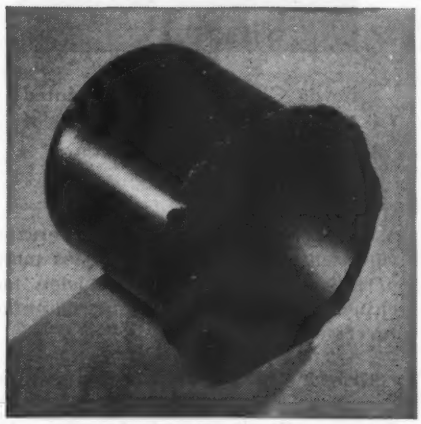


This is the sixth in a series of messages designed to better your knowledge about the machining and finishing of molded phenolics —the most versatile of all plastics . . . the type of plastics which Durez has specialized in producing during the past quarter century.

When a molded phenolic part is ejected from the mold, in most instances, it is completely finished except for the "fin" which occurs at the flash point. Under normal conditions the fin thickness averages .015" and if located on the edge of the molded piece, is removed by a process referred to as "tumbling."

Tumbling Barrels

Open type tumbling barrels are usually round or hexagonal in shape and are constructed from heavy wire mesh or perforated metal. This type barrel is recommended in preference to the solid closed barrel because of the fact that when the flash breaks off from the molded part, it becomes pulverized and is extremely difficult to clean from the surfaces of the tumbled parts.



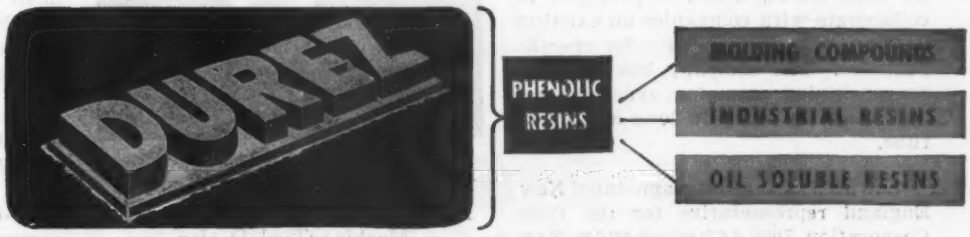
Typical Durez phenolic molded part before the fin has been removed by tumbling.

Recommended Procedure

For best results, barrels should be loaded at least 75% full. This is especially true when the molded parts have metal inserts or are large. If too small a quantity is tumbled, the parts will be subjected to too much drop with excessive breakage and damage to the inserts as the consequence. In the case where the molded parts are very lightweight, it is advisable to tumble them with medium sized wooden blocks to speed up the process of fin removal.

Time Factor

Recommended speed for the tumbling barrels is 40 to 70 RPM. The time required depends on many factors—type of material, design and shape of piece, thickness of fin, and the amount of charge in the barrel. Under average conditions, 10 minutes tumbling is sufficient for proper removal of fin from a Durez phenolic molded part. The benefits of the vast experience which Durez technicians have acquired during the past quarter century are available at all times toward furthering your progress in the machining and finishing of phenolic plastics. Durez Plastics & Chemicals, Inc., 5812 Walck Road, North Tonawanda, N. Y.



PLASTICS THAT FIT THE JOB

Federal Products Corporation, Providence, R. I. He was previously assistant to the general manager of the Wright Aeronautical Corporation, Paterson, N. J., on special assignments.

CHARLES B. PICKERING, for five years industrial application engineer in Connecticut, and more recently field engineer on radar equipment for the Bureau of Ships at Charlestown Navy Yard, Boston, Mass., has recently joined the Boston office of the Allen-Bradley Co., as sales engineer. He will serve the New England territory as application engineer for Allen-Bradley solenoid motor controls.

A. F. FISHER has been appointed manager of engineering and manufacturing for the Warren Telechron Co., Ashland, Mass., manufacturer of synchronous motors and electric clocks.

New Jersey

ROBINS CONVEYORS, INC., Passaic, N. J., manufacturer of materials-handling machinery, has opened new offices in the Brown-Marx Bldg., First Ave. and 20th St., Birmingham, Ala., under the direction of CHARLES A. THOMPSON, who served the company before the war as a sales engineer in the Pittsburgh office. C. B. DAVIS, who previously was agent for the company in the Birmingham district has retired from business.

F. A. GUBA has been appointed eastern manager of sales, and F. D. ARCHER has been made midwestern sales manager of the Carpenter Steel Co., Welded Alloy Tube Division, Kenilworth, N. J. Mr. Guba will make his headquarters at Kenilworth, and Mr. Archer will be located at 221 N. LaSalle St., Chicago, Ill.

COLONEL LOUIS F. W. STUEBE has returned from the armed services and rejoined the Chicage sales engineering staff of the Hyatt Bearings Division of General Motors Corporation, Harrison, N. J.

New York

SPECIAL MACHINE TOOL ENGINEERING WORKS, 132 Lafayette St., New York 13, N. Y., has organized an auxiliary service department, which is prepared to collaborate with companies on existing designs or to design parts for specific purposes. The company has capacity for machining, stamping, experimental, and assembly work in long and short runs.

LEWIS CLARE has been appointed New England representative for the Cosa Corporation, 5000-4 Chrysler Bldg., New York 7, N. Y. The Cosa Corporation represents in the United States many of the outstanding high-precision machine tool and instrument manufacturers of Switzerland.

Lewis Clare, Newly Appointed New England Representative of the Cosa Corporation

GEORGE T. FRASER has been appointed Rexalloy Division manager of the Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y. I. S. MCREAVY, formerly manager, has resigned to manage his automobile sales agency at Midland, Mich.

F. C. HICKEY has become associated with the Ganey Machinery Co., 1807 Elmwood Ave., Buffalo 7, N. Y., machine tool dealer and appraiser of manufacturing plants. The company is affiliated with the Rogers Machine Works, Inc., of Alfred, N. Y. Before joining the Ganey Machinery Co., Mr. Hickey was associated with the Curtiss-Wright Corporation.

F. C. Hickey, Who has Recently Joined the Ganey Machinery Co., Machine Tool Dealer

PRECISION CASTINGS CO., INC., Syracuse, N. Y., announces the following changes in its sales department: LESTER H. PILLION has been appointed eastern sales manager, with offices in the Chrysler Bldg., New York 17, N. Y., and ROSS W. CASTLE has been appointed western sales manager, with headquarters at the Cleveland plant, 12600 Berea Road, Cleveland 11, Ohio. The company also announces the appointment of J. J. PUNKE as factories manager and chief engineer, with ALBERT LINTEL assisting him at the Syracuse and Fayetteville plants as factory manager. J. R. MILLSPAUGH has been made general manager of the Cleveland plant, and A. D. WEIGOLT factory manager of that plant. STANLEY FROST has been appointed president of the Kalamazoo Division, and C. M. HYDE vice-president and general manager.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces that the Motor Division of the Apparatus Department has been reorganized because of the large volume of electric motor business. The Motor Division has been separated into four divisions and one section. The following men head the four motor divisions: A. W. BARTLING, ELLIOTT HARRINGTON, J. T. FARRELL, and P. A. MCTERNEY. W. H. HENRY, formerly manager of the Motor Division, has been appointed assistant manager of the Industrial Divisions in charge of motor business, and will be assisted by E. A. GREEN and D. E. MOORHEAD.

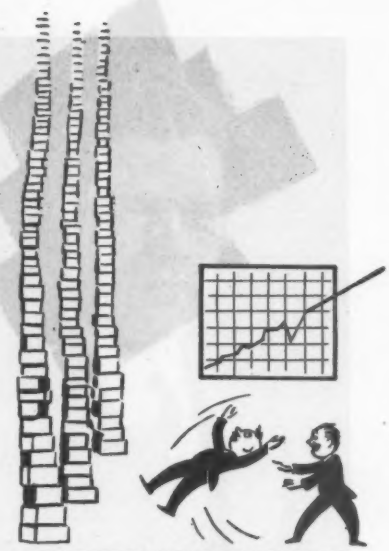
E. V. CRANE has been made vice-president of Sam Tour & Co., engineers, metallurgists, and consultants, with offices and research laboratories at 44 Trinity Place, New York 6, N. Y. Mr. Crane will be in charge of mechanical engineering and metal-working projects and research. He is an authority on pressed metal engineering and will continue his interests in stamping and work hardening problems. For many years he was associated with the E. W. Bliss Co.

N. A. MOERMAN has been appointed sales engineer for the Potter Instrument Co., 136-56 Roosevelt Ave., Flushing, N. Y., designer and manufacturer of high-speed electronic counting control equipment.

WILLIAM F. HOSFORD, vice-president and director of the Western Electric Co., 195 Broadway, New York 7, N. Y., since 1928, has recently completed forty-five years of service with the company.

WHY IT PAYS TO USE THE *RIGHT* CUTTING OIL

LONGER TOOL LIFE



HIGHER PRODUCTION

CLOSER TOLERANCE

BETTER FINISH

BETTER CHIP SEPARATION

SHELL HAS THE *RIGHT* CUTTING OIL FOR EVERY APPLICATION

SHELL KNOWS THE IMPORTANCE of using the right oil for a particular cutting job. That is why Shell Lubrication Engineers balance the oil to fit the machine . . . the application . . . and the tool.

Make sure the machines in your plant get the benefit of all that's new in lubrication. Call the Shell Lubrication Engineer. Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL

SHELL CUTTING OILS

FOR METAL CUTTING AND GRINDING

H. F. Kneen, Vice-president in Charge of Manufacturing, Lincoln Electric Co.

Ohio

H. F. KNEEN has been appointed vice-president in charge of manufacturing, and G. G. LANDIS vice-president in charge of engineering for the Lincoln Electric Co., Cleveland, Ohio. Mr. Kneen was previously general plant superindent. He joined the company in 1929, shortly after graduating from Cornell University. Mr. Landis, formerly chief engineer, became connected with the company in 1924, a few years after graduating from Ohio State University.

CINCINNATI LATHE & TOOL CO., Oakley, Ohio, has recently filed papers of incorporation in Columbus, Ohio, with a capitalization of $100,000. The new company has acquired the land, buildings, machinery, designs, inventory, unfilled orders, and trade name of the Cincinnati Lathe & Tool Co. of Oakley, which has discontinued manufacturing operations because of the retirement of president, W. C. HEINDEL. The new concern is a subsidiary of the Cincinnati Milling Machine Co., but will be entirely independent in operation. It will continue the manufacture of Cintilathes in sizes from 14 to 32 inches. The new officers are MILLARD ROMAINE, president; and E. W. MUELLER, secretary-treasurer.

DR. CHARLES H. HERTY, JR., of Bethlehem, Pa., was elected national president of the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio, at the recent annual meeting. Other officers elected were: Vice-president, A. L. BOEGEHOLD, head of the metallurgy department, Research Laboratories Division, General Motors; and treasurer, DR. H. K. WORK, manager of research and development, Jones & Laughlin Steel Corporation.

PAUL H. SHAEFFER has been appointed Cleveland district manager of the Vanadium Corporation of America, 420 Lexington Ave., New York 17, N. Y. Mr. Shaeffer's headquarters will be in the Union Commerce Bldg., Cleveland, with the Cleveland-Cliffs Iron Co., who will continue to serve as agent for the Vanadium Corporation of America.

WILLIS ENGINEERING CO., has announced that the general offices of the concern have been moved to Burton, Ohio, and that a new office has been opened in Cleveland at 206 Plymouth Bldg. The company acts as Ohio distributor for the oil filtration products of the Briggs Clarifier Co., Bethesda, Md.

JOHN M. PARKS has joined the staff of the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio, as editor of technical books. He will also assist in the work of the educational committee and prepare lecture series for use by the various chapters of the Society.

JOHN THOMPSON, for the last twenty years chief engineer of the Pipe Machinery Co., Cleveland, Ohio, has established a residence in Phoenix, Ariz., where he will act as sales representative for the gages and tools made by the Pipe Machinery Co.

NIKOLA TRBOJEVICH has recently been added to the engineering staff of Jack & Heintz, Inc., Cleveland 1, Ohio, manufacturers of aircraft accessories and precision instruments. Mr. Trbojevich, a gear expert, was connected with the Illinois Tool Works, Chicago, Ill., from 1915 to 1920. Since 1920 he has been an independent inventor and consulting engineer, and has acquired over sixty United States and many foreign patents, including a patent on a new type spiral bevel and hypoid gearing, together with tools and machines for its manufacture.

Nikola Trbojevich, Now a Member of the Engineering Staff, Jack & Heintz

G. G. Landis, Vice-president in Charge of Engineering, Lincoln Electric Co.

PROFESSOR R. D. LANDON has been appointed dean of the College of Engineering of the University of Akron, Akron, Ohio. He was previously professor of civil engineering in the Southern Methodist University, Dallas, Texas.

GEROTOR MAY CORPORATION, Logansport, Ind., has appointed the GARCO MACHINERY CO., Cleveland, Ohio, representative in the Cleveland territory for Gerotor air and hydraulic valves and cylinders and hydraulic pumps.

BAKER INDUSTRIAL TRUCK DIVISION of BAKER-RAULANG CO., Cleveland, Ohio, has appointed GEORGE S. FORMAN direct factory representative in Latin America for its line of power industrial trucks, tractors, and cranes.

KELLY REAMER CO., Cleveland, Ohio, has appointed ROBERT W. GLOYD, 1217 E. 3rd St., Dayton, Ohio, sales and engineering representative for the company in Dayton, Springfield, Hamilton, and vicinity.

EDWARD C. HOENICKE, formerly assistant general manager of the Eaton Mfg. Co.'s Foundry Division, Cleveland, Ohio, has been appointed general manager of the division.

S. D. MAHAN has been appointed vice-president and general sales manager of the Manufacturing Division of the Crosley Corporation, Cincinnati, Ohio.

did you know that you can get this Hardware

IN STAINLESS STEEL?

...and one call will do it all

CAMBRIDGE, MASS.
TROWBRIDGE 7000

INDUSTRIAL STEELS, INC....with America's largest warehouse stock of stainless shapes and parts...carries a complete line of the hardware and fittings shown above, in all sizes and types. Any of these standard parts can be shipped immediately on receipt of your order.

In addition to stainless hardware and fittings, INDUSTRIAL STEELS, INC. maintains complete stocks of stainless sheet, bars, tubes, wire, valves, and welding electrodes ...ready for prompt deliveries.

You pay no price premium for this convenient service. For anything in stainless steel, it will pay you to get in touch with INDUSTRIAL STEELS, INC. ...and let one call do it all.

For More Information, Write For This Catalog

JMLCo CI-M1

INDUSTRIAL STEELS, Inc.

250 Bent Street, Cambridge 41, Mass. · TROwbridge 7000 · Teletype: Cambridge 547

Pennsylvania

QUAKER CHEMICAL PRODUCTS CORPORATION, Conshohocken, Pa., announces the following additions to its staff of field engineers.

JOHN N. CARLSON, formerly engineer and metallurgist for several aircraft and ball bearing manufacturers, has taken over the Philadelphia territory formerly handled by PETER J. SCHWAB, who has retired after more than twenty-five years' service with the corporation. CHARLES D. TITER, previously engaged in chemical work for Robbins & Myers, Inc., is now representing the corporation in Springfield, Ohio, and adjacent territory. JAMES D. STEVENS, JR., formerly a process engineer with the Wright Aeronautical Corporation, will cover the states of Wisconsin and Minnesota from his headquarters in Milwaukee. ROGER M. BAKER, formerly maintenance superintendent of the Consolidated Vultee Aircraft Corporation at Allentown, Pa., has been appointed to the Cleveland, Ohio, area. Sharing this territory with Mr. Baker is GRANT H. LEWIS, who was previously assistant to the works manager of the Dodge Chicago Division of Chrysler Corporation.

WESTINGHOUSE ELECTRIC CORPORATION, Pittsburgh, Pa., announces the following changes in its Editorial Service: HENDLEY BLACKMON has resigned as manager to join the McGraw-Hill Publishing Co., New York, in the capacity of electrical editor of *Product Engineering*. Pending the return of LIEUTENANT CARL NAGLE, now on duty in the Pacific with the United States Navy, H. C. MCDANIEL will act as supervisor of Editorial Service. Mr. Blackmon has been associated with the Westinghouse organization since his graduation from Georgia School of Technology in 1925 as an electrical engineer. He has been manager of Editorial Service since 1938. Mr. McDaniel joined the Westinghouse Lamp Division in 1939. He has been a member of the staff of Editorial Service since 1943. Lieutenant Nagle joined Westinghouse Editorial Service in 1941 and was granted a leave of absence in 1943 to enter the Navy.

SOUTHWARK DIVISION OF THE BALDWIN LOCOMOTIVE WORKS, Philadelphia 42, Pa., announces that field sales engineers have been placed in five of the company's branch offices to give advice on applications of the SR-4 strain gage. The new appointees are RICHARD HANNON, Boston, Mass.; JOSEPH FARLEY, Chicago, Ill.; ROBERT CLEELAND, New York City; GLENN ROWELL, Philadelphia, Pa.; and STANLEY ZANSITIS, Detroit, Mich. JORDAN H. GAUL is sales manager for the SR-4 strain gage at the Eddystone, Pa. office.

WILLIAM C. UECKER has joined the staff of the Carbide Die & Mold Co., Pittsburgh, Pa., in the capacity of treasurer and sales manager. ERNEST G. MERLIN has been made secretary and sales representative of the company. Both men have had long experience in the tungsten-carbide field.

FRANK ST. VINCENT, who has been affiliated since the first of the year with the operating department of the Niagara Falls, N. Y. plant of the Vanadium Corporation of America, has been appointed sales engineer of the Pittsburgh district.

L. D. T. BERG, for the last five years a sales engineer in the Electric Welding Division of the General Electric Co., Schenectady, N. Y., has been appointed welding specialist of the company's Atlantic district, with headquarters in Philadelphia, Pa.

W. HARRISON LACKEY has been named sales representative in York, Pa., and vicinity for the Lukens Steel Co. and subsidiaries, By-Products Steel Corporation and Lukenweld, Inc., Coatesville, Pa.

Wisconsin and Minnesota

E. U. LASSEN has been appointed assistant chief engineer of Cutler-Hammer, Inc., Milwaukee, Wis. Mr. Lassen has been connected with the company since 1924, starting as a draftsman and advancing to the positions of designing engineer, engineer supervisor, and finally to his present post of assistant chief engineer.

DREMEL MFG. CO., Racine, Wis., manufacturer of portable electric tools, has started construction on a new plant to provide better and more convenient working conditions.

MILTON GRANQUIST, 808 LaSalle Ave., Minneapolis 2, Minn., is acting as special representative in the Minnesota territory for HARDINGE BROTHERS, INC.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933,

of MACHINERY, published monthly at New York 13, N. Y., for October 1, 1945.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the state and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the treasurer of The Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editors, managing editor, and business managers are: Publisher, The Industrial Press, 148 Lafayette Street, New York 13, N. Y.; Editors, Erik Oberg and Franklin D. Jones; Managing Editor, Charles O. Herb; Business Managers, Robert B. Luchars, Edgar A. Becker, and Erik Oberg. The address of all the foregoing is 148 Lafayette St., New York 13, N. Y.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press, Robert B. Luchars, Edgar A. Becker, Franklin D. Jones, Walter E. Robinson, Charles O. Herb, and Harold L. Gray, all of 148 Lafayette St., New York 13, N. Y.; Helena E. Oberg, 65 Eighty-second St., Brooklyn 9, N. Y.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; First National Bank & Trust Co. of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank & Trust Co. of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank & Trust Co. of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; Paterson Savings Institution, Trustee (Beneficiaries unknown), Paterson, N. J.; Robert Luchars Urban, 51 Ellery St., Cambridge 38, Mass.

3. That the known bondholders, mortgagees, and other security holders are: Charlotte B. Baldwin, 420 Clinton Ave., Brooklyn, N. Y.; Robert B. Luchars, John Connolly, Franklin D. Jones, and Louis Pelletier, all of 148 Lafayette St., New York 13, N. Y.; Elizabeth Y. Urban, 163 Western Drive, Longmeadow, Mass.; Helen L. Ketchum, 231 King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; and Henry V. Oberg, 1317 Hillcrest Rd., Lancaster, Pa.

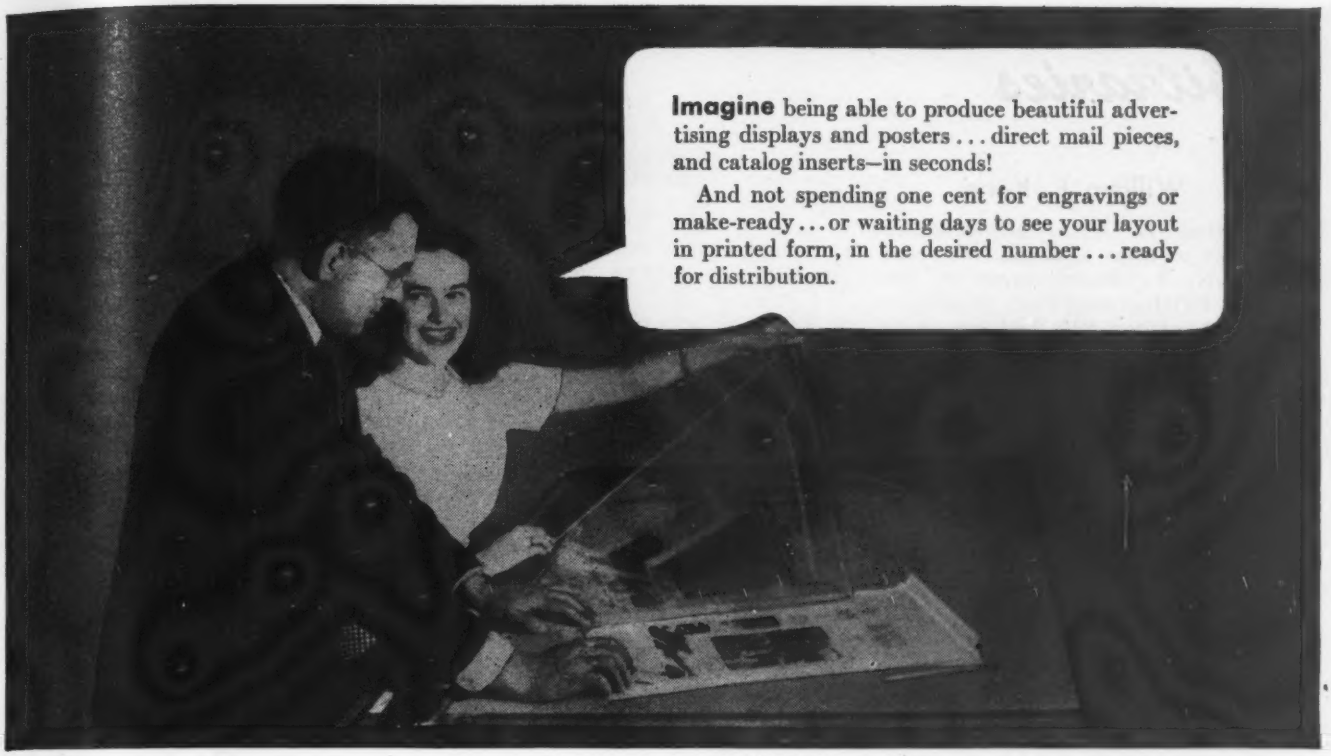
4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 1st day of October, 1945.

CHARLES P. ABEL

(SEAL) Notary Public, Kings County No. 321
Kings Register's No. 116-A-7
New York County No. 325, New York Register's No. 153-A-7
(My commission expires March 30, 1947)


Imagine being able to produce beautiful advertising displays and posters . . . direct mail pieces, and catalog inserts—in seconds!
And not spending one cent for engravings or make-ready . . . or waiting days to see your layout in printed form, in the desired number . . . ready for distribution.

What artist wouldn't smile!

What holds true in the drafting room or office . . . is also true in the Art Department!

Any translucent original can be reproduced in an Ozalid machine in seconds. And reproduced—not as a negative—but as any one of ten different types of positive, Ozalid prints. In different colors (black, blue, red, or sepia) . . . and on different base materials (paper, cloth, foil, or film).

Consider the over-all convenience of this Ozalid service: An idea can be conceived, a layout prepared . . . and a thousand Ozalid prints made—in the desired color and on the desired material—in less than two hours' time.

Each print full of sales appeal—and as easy to read as the original, whether it be a reproduction of a line drawing or a photographic subject.

In other ways, too, Ozalid saves time, labor, and materials for the average Art Department: An Ozalid print of a layout can be altered with a corrector fluid and changes drawn in; previously used illustrations may be repeated with new copy; a different effect can be created—not by redrawing—but simply by changing the position of originals and making a new print; if you advertise in papers or magazines, you can send Ozalid prints which actually produce superior engravings.

Helping the artist is only one of Ozalid's jobs. Like the average user, you will probably employ Ozalid to reproduce your engineering drawings, typed sheets, business machine reports, photographs, in fact, the work of all departments.

For no other technical reproduction process offers a business organization such versatility, economy, speed, and convenience!

Write today for free catalog and samples of the 10 types of Ozalid prints you can make from any of your originals.

OZALID

DIVISION OF GENERAL ANILINE AND FILM CORPORATION
JOHNSON CITY, N. Y.

OZALID IN CANADA—HUGHES-OWENS CO., LTD., MONTREAL

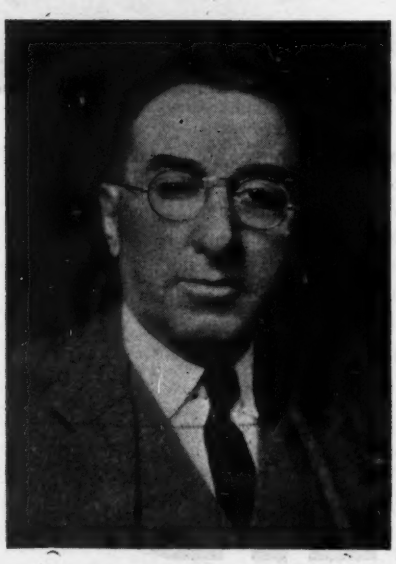
Obituaries

William E. Kane

William E. Kane, president and founder of Kane & Roach, Inc., Syracuse, N. Y., manufacturer of cold-rolled forming machinery, straightening and bending rolls, and special machinery, died on October 11 at the age of seventy-nine years. Mr. Kane was born in Baldwinsville, N. Y., on January 27, 1866. His bent for mechanics was so pronounced that he left school at sixteen years of age to enter the employ of Heald & Morris, predecessors of the Morris Machine Works, in Baldwinsville, with whom he served a three-year apprenticeship. Then, for a brief period, he left the machine field to operate a book agency in Syracuse.

The present business had its inception in September, 1887, when Mr. Kane founded the Monarch & Eureka Co. which engaged in the manufacture of chemical boiler filters. Associated with Mr. Kane from the start of the business as a salesman in his employ was his brother-in-law, Bartholomew F. Roach. In 1891, Mr. Roach was admitted to partnership, and the firm of Kane & Roach was formed. In 1898, the company bought the site on which the present plant is located.

Through the span of more than half a century, Mr. Kane designed and manufactured a long line of machines, including pumps, hydraulic presses, wheel drills, multiple punches, spoke drivers, band saws, jointers, planers, and drill presses, in addition to the principal products of the concern—the cold-rolled forming machine, straightening machine, and the wrapping type bender, each of which was the first of its type on the American market.



William E. Kane

Arthur Charles Payne

Arthur Charles Payne, who for over twenty-six years was connected with MACHINERY as subscription representative, died on October 17. Mr. Payne was born in Silver Creek, N. Y., November 25, 1884. After having attended the Silver Creek High School and Bryant & Stratton's Business College at Buffalo, N. Y., he was employed as a bookkeeper by S. Howes Co., of Silver Creek, makers of grain-cleaning machinery. Later, he was associated with the Aluminum Castings Co., of Buffalo, as superintendent, being subsequently, transferred to that company's plant in Cleveland.

Mr. Payne became associated with MACHINERY as subscription representative in the upper New York territory in June, 1919, and at his death had been representing MACHINERY in the field for a longer period of time than any other member of the subscription staff. He was very highly thought of by all in the organization who came in contact with him for his outstanding integrity and ability in his chosen work. He made a host of friends in the territory that he covered. Mr. Payne is survived by his widow, Mae A. Payne, of Silver Creek, N. Y.

FRANK C. ANGLE, manager of the General Machinery Division field sales offices of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., died on October 25 after an illness of several months, at the age of forty-five years. Mr. Angle had been field sales manager since 1944. He joined the Allis-Chalmers organization in 1929 as a salesman in the Chicago office. In 1934 he was transferred to the company's San Francisco office, of which he became manager two years later. He was appointed Pacific regional manager in 1943.

HARRY W. COWAN, sales manager of the Machine Tool Division of the Chas. A. Strelinger Co., Detroit, Mich., for the last twenty-eight years, died on November 5 after a short illness.

Coming Events

DECEMBER 3-5—National Air Transport Engineering meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Edgewater Beach Hotel, Chicago, Ill. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 5-7—Fiftieth annual meeting of the NATIONAL ASSOCIATION OF MANUFACTURERS at the Waldorf-Astoria Hotel, New York City. For further information, address the Association at 14 W. 49th St., New York 20, N. Y.

JANUARY 7-11—PLASTICS EXHIBIT and annual meeting of the SOCIETY OF PLASTIC ENGINEERS in Detroit, Mich. Exhibit will be held in Convention Hall and meeting in the Horace H. Rackham Educational Memorial, 100 Farnsworth Ave. Further information can be obtained from Fred Conley, chairman of the publicity committee, 510 Stephenson Bldg., Detroit 2, Mich.

JANUARY 7-11—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS and Engineering Display at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

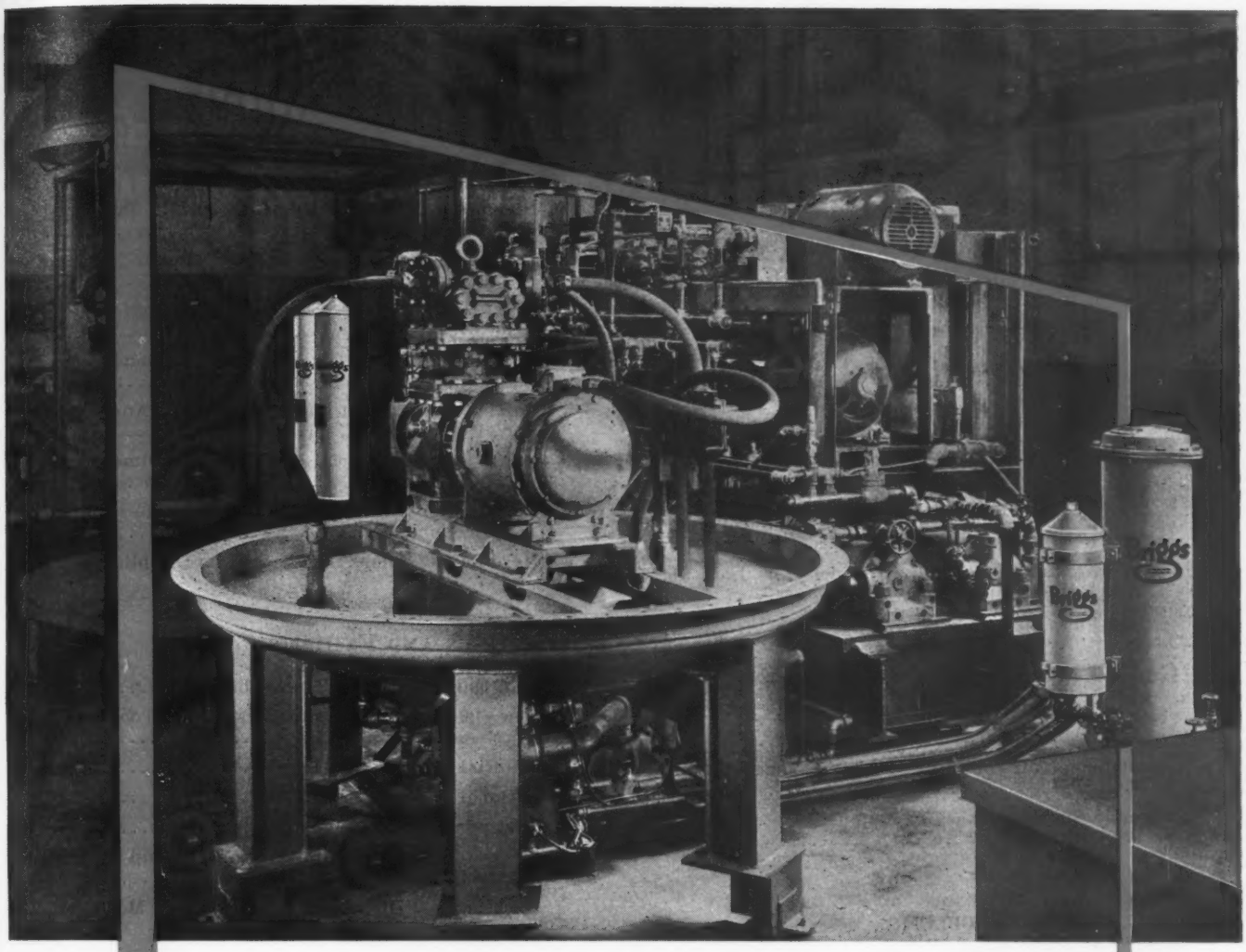
FEBRUARY 4-7—National meeting of the AMERICAN WELDING SOCIETY in Cleveland, Ohio; headquarters, Hotel Cleveland. Secretary, Miss M. M. Kelly, 33 W. 39th St., New York City.

FEBRUARY 4-8—METAL CONGRESS AND TWENTY-SEVENTH NATIONAL METAL EXPOSITION at the Public Auditorium, Cleveland, Ohio. Also annual convention of the AMERICAN SOCIETY FOR METALS in Cleveland; headquarters, Hotel Statler. National secretary, 7301 Euclid Ave., Cleveland 3, Ohio.

FEBRUARY 4-8—National meeting of the IRON and STEEL and INSTITUTE of METALS DIVISIONS of the AMERICAN INSTITUTE of MINING and METALLURGICAL ENGINEERS in Cleveland, Ohio; headquarters, Statler Hotel. Assistant secretary, Frank Sisco, 29 W. 39th St., New York 18, N. Y.

FEBRUARY 25—MARCH 2—Twentieth Exposition of Chemical Industries at Grand Central Palace, New York City. For further information, address Exposition of Chemical Industries, Grand Central Palace, New York 17, N. Y.

APRIL 3-5 — National Aeronautical meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel New Yorker, New York City. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.



"BRIGGS HYDRAULIC OIL CLARIFIERS *Prevent Trouble* FOR US.."

SAYS THE CHIEF ENGINEER OF GEROTOR MAY CORPORATION, MANUFACTURERS OF THE FAMOUS GEROTOR PUMP

The Gerotor May Corporation installed Briggs Oil Clarifiers on this huge, yet delicate test stand for 3 REASONS—

1 They knew that maintaining hydraulic oil in perfect condition is the only practical way to prevent trouble . . . to reduce wear . . . to lengthen life of expensive equipment.

2 The performance demanded of this equipment made it imperative that protective measures be taken to safeguard its built-in ability to do a perfect job at all times.

3 Conviction, after thorough investigation, that the Briggs principles of oil filtration give greater protection and that Briggs Oil Clarifiers had proved their ability to remove all types of contaminants from oil. AFTER TWO YEARS OF OPERATION, BRIGGS PERFORMANCE JUSTIFIED THEIR CHOICE.

If you operate hydraulic equipment, you, too, must realize the importance of the first two reasons. And, you too, will come to the same conclusions Gerotor May engineers did, once you take only five minutes to become acquainted with Briggs Oil Clarifiers and learn WHY they offer you so much more protection against oil contamination and oxidation—the two enemies of hydraulically-operated equipment.

The Briggs distributor in your locality is at your service . . . ready to show you what Briggs Oil Clarifiers have done for others . . . HOW AND WHY AND WHAT they can do for you. Call him . . . prevent trouble before it begins.

Briggs

PIONEERS IN MODERN OIL FILTRATION

BRIGGS CLARIFIER COMPANY General Offices - Bethesda 14, Md.

DISTRIBUTORS IN PRINCIPAL CITIES • LISTED UNDER "FILTERS" IN MOST CLASSIFIED TELEPHONE DIRECTORIES.

Classified Contents of This Number

Brazing Practice

Copper Furnace Brazing—*By Glen A. Robinson*.. 139
Brazing Tool Tips to Shanks by Induction Heating —*By T. A. Vernor and E. F. Adams*..... 178

Diemaking, Die Design, and Press Work

Hydraulic Strippers Facilitate Drawing of Thin Shells—*By Henry F. Hild*..... 147
Aircraft Manufacturing Technique Applied to Bus Building—*By R. B. Stubbs*..... 168
Die for Forming Extruded Rivet in Sheet-Metal Plate—*By Wallace C. Mills*..... 191
Spring-Actuated Receding Guides for Locating Work in Coining Die—*By L. Kasper*..... 192

Gaging and Inspection

Method of Checking Compound Angles— *By James Ahearn*..... 182
Instrument for Checking Bore Diameters in Long Cylinders—*By Daniel E. McDonald*..... 192
Simple Gage for Checking Pump Gears— *By G. A. Almorth*..... 193

Management Problems

A Common-Sense Theory of Taxation..... 164
Putting Surplus Machine Tools to Work..... 176
Government Price Control Has No Place in Times of Peace 179
How Germany Built up Its Manufacturing Industries..... 180
The Sole Purpose of Industry is to Serve the Consumer..... 181
Initiative and Enterprise are the Cornerstones of Industry..... 188
Industry Must Use Today's Knowledge..... 188
Production is the Main Foundation of Maximum Employment..... 189
When is a Purchasing Agent Personally Liable for Contracts He Has Signed?—*By Leo T. Parker*.. 195

Materials, Metals, and Alloys

Carbide Used for Tool Grinder Ways..... 160
Vinylite Plastics—New Applications of a Product of the Bakelite Corporation..... 185
The Problem of Cutting Fluids..... 194
Machine-Tool Cast Iron..... 195
Meehanite for Screw Machine Cams..... 195
New Free-Cutting Copper Rod Saves Machining Time..... 196
Non-Flammable Thermosetting Plastic Developed by Goodrich..... 196
Improved Grease for Ball and Roller Bearing Motors..... 196
Flux for Aluminum Soldering, Brazing, or Gas Welding..... 196
Synthetic Plastic Adhesive for Laminated Construction..... 197
Special Low-Carbon Ferro-Manganese Announced by Electromet..... 197
New Ceramic Material Has Unusual Dimensional Stability..... 197
Rust Inhibitors Developed for Inside Storage Protection..... 197
Hard-Facing Alloys for Electric Arc Application.. 197

Meetings and Exhibits

Tool Engineers Plan Exposition..... 146
New Officers of the National Machine Tool Builders' Association 154
Material Handling Society Formed..... 160
National Patent Council..... 167
Meeting of Committee on Cutting Fluids..... 194
Annual Meeting of the National Metal Trades Association..... 198
Machine Tool Distributors Hold Annual Meeting.. 198

News of Industry

Pope Machinery Corporation Celebrates Twenty-Fifth Anniversary 177
Engineering News..... 186
News of the Industry..... 239

Shop Practice

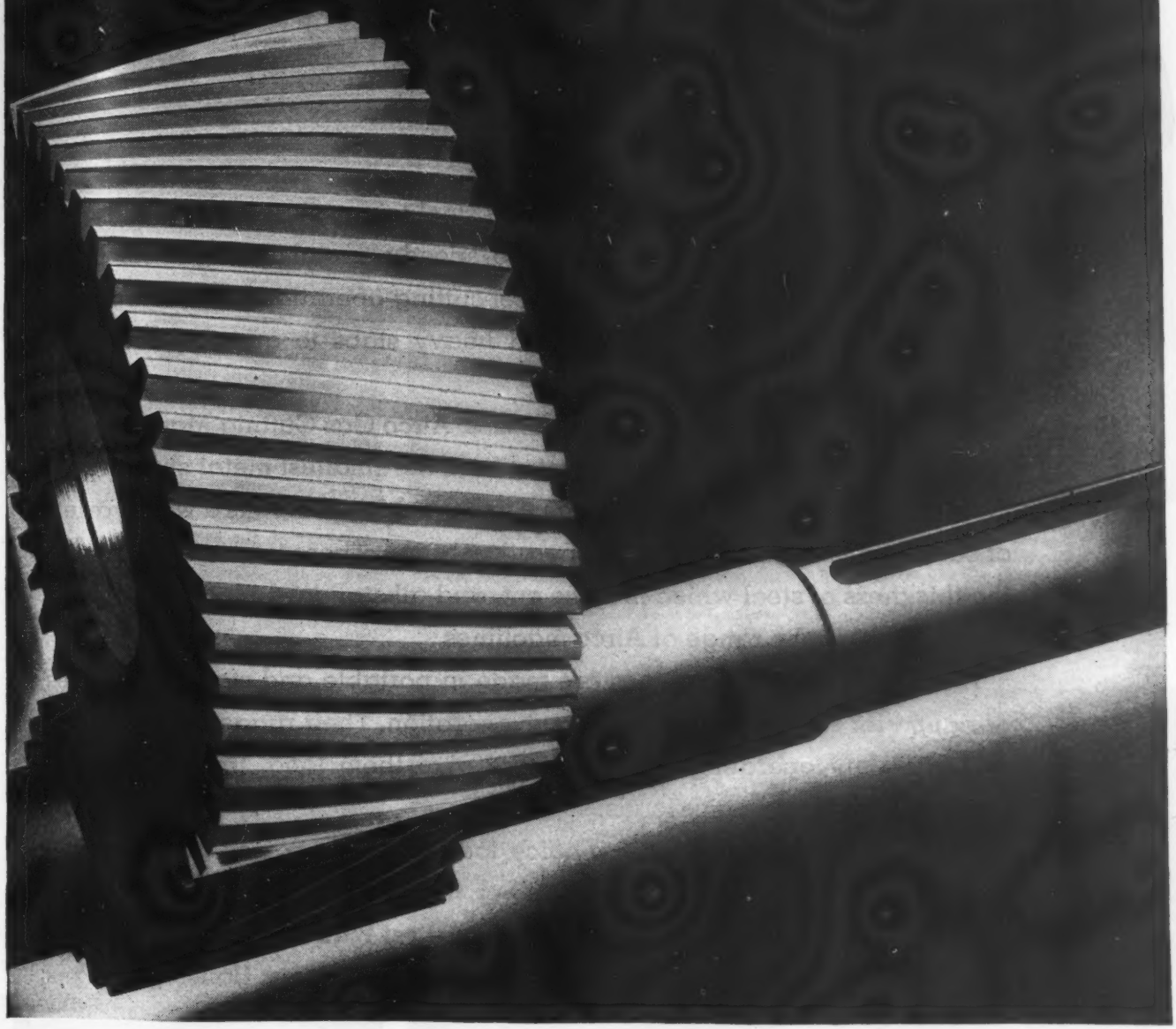
Belt Grinding—One of the Later Developments in the Grinding Field—*By W. A. Papworth*..... 155
Recent Applications of the Thread-Rolling Process 161
Surface Finish of Crankshaft Bearings Improved at Cadillac..... 164
Use of Solvents in Cleaning Machinery for Reconversion—*By Mable Foy*..... 165
Simplified Practice for Machine, Carriage, and Lag Bolts..... 177
Demonstration of Kennamilling 179
Shop Equipment News..... 199

Training, Apprentice

Increase in Apprentice Training..... 181
Apprentice Training for Returning Servicemen.. 185

Your Progress Depends Upon Your Knowledge of Your Industry

Molybdenum gives steel the strength and toughness necessary to make long-lived gears.



CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company

500 Fifth Avenue • New York City

MOLY

Modernize your meta

Here's the fast, modern method of cutting steel to any shape, practically any size, and in most any quantity. These speedy, metal-cutting tools bring new economy and flexibility to all steel-cutting operations . . . from squaring and shaping of large plates and heavy slabs to quantity-cutting of small steel parts.

Made in a wide range of types and sizes, Airco Gas Cutting Machines are designed to meet the needs of industry from the smallest metal shops to the largest steel fabrication plants. Each Airco machine performs a wide variety of cutting jobs within its specific operating range. There is almost no limit to the thickness of steel which may be cut, and all standard plate thicknesses are well within the range of Airco machines.

Airco Gas Cutting Machines are made in portable and stationary types, designed for single and multiple torch operation. Their rugged construction and excellent operating characteristics give them long, trouble-free life, even under heavy service loads.

Call or write your local Airco office today for free copies of descriptive booklets on Airco Gas Cutting Machines or, if you prefer, address your request Dept. M, Air Reduction, General Offices: 60 East 42nd St., New York 17, N. Y. In Texas, Magnolia Airco Gas Products Co., General Offices: Houston 1, Texas.

AIR REDUCTION

OFFICES IN ALL PRINCIPAL CITIES

AIRCO

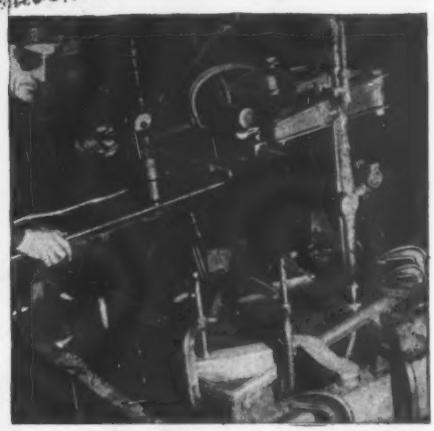
cutting methods with

AIRCO GAS CUTTING MACHINES

...A TYPE AND SIZE FOR EVERY CUTTING NEED

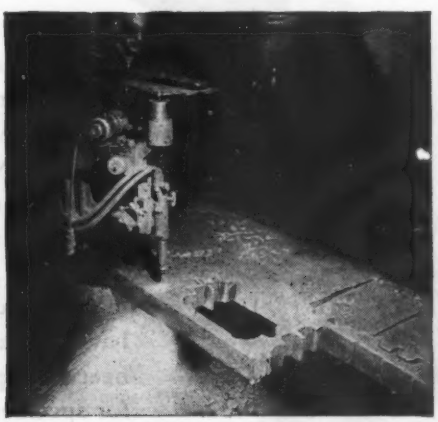
Squaring, beveling and many similar cutting jobs are performed swiftly and accurately by the Airco No. 10 Radiagraph. Lightweight and portable, this little motor-driven machine also cuts arcs and circles up to 85" in diameter.

Large-area cutting and quantity production of small parts is speeded by the Airco No. 41 Travograph, a motor-driven machine which moves on a track located alongside the work. Multiple cutting torches are guided by a tracing device which follows a cam or template of the required shape.



Stack cutting small parts with the Airco Planograph. Identical parts of any design are accurately shaped in one operation by "stacking" the plates to any thickness within range of the cutting torch.

Pipe cutting and beveling simultaneously with the portable Airco No. 1 Pipe Cutting and Beveling Machine. This handy machine requires no power. It is operated by a crank which revolves the machine around the pipe. If desired, the machine may be held stationary while the pipe is revolved.



For fast cutting of small shapes the Airco No. 5 Camograph is ideal. It cuts parts of any contour by means of a motor-driven template roller which follows a metal template of the required shape. This in turn controls movement of the torch, and assures speedy, accurate cutting.

Continuous, curved bevel cuts and special symmetrical shapes are made with the Airco No. 10 Polygraph, a motor-driven machine that travels on a track which is also the template for the cut. The Polygraph is one of many Airco machines designed for special cutting operations.

Cutting Machines

friction insurance

for your 1946 Production

DURING almost half a century, BCA Ball Bearings have been reducing friction... providing smooth, dependable machine performance... for leading manufacturers. Now, once more, these bearings are available on a normal delivery basis.

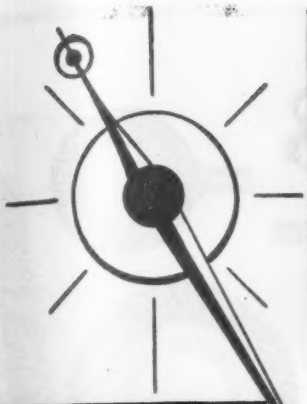
Equipment makers and equipment users have both found that they reduce equipment maintenance when they specify BCA. They have learned that BCA Ball Bearings are engineered to provide an ample margin of safety for specified shocks, loads and thrusts. That's why you will benefit by discussing your needs with BCA—whether you need radial, thrust or angular contact ball bearings.

BEARINGS COMPANY OF AMERICA
LANCASTER, PENNA.

BCA

RADIAL • ANGULAR CONTACT • THRUST

BALL BEARINGS



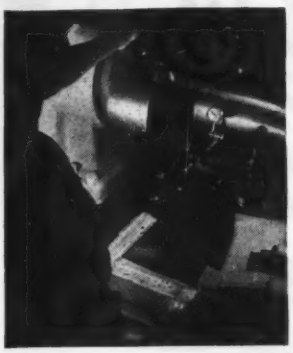
Wherever Dial Indicators Are Indicated

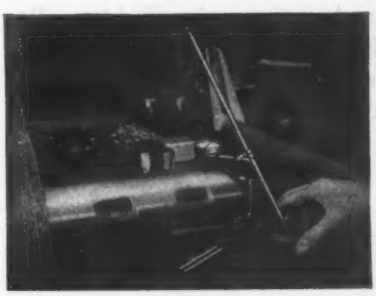
Make 'Em **STARRETTS**

These pictures of Starrett Dial Indicators and "Last Word" Indicators on critical production jobs are better than a "thousand words" as evidence that Starrett accuracy and durability applies to Starrett Indicator Gages as well as to all other Starrett Precision Tools.

Starrett Dial Indicators cover every range and requirement of machine, jig and fixture application and of inspection work. Easy to read, sturdily constructed for lasting accuracy, your workers and inspectors welcome any Indicator that has the Starrett name on the dial.

Let us mail you Starrett Dial Indicator Catalog "D".





Now, with 4 Service Stars

THE L. S. STARRETT CO. · ATHOL · MASSACHUSETTS · U. S. A.

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BAND SAWS • STEEL TAPES

STARRETT TOOLS

Highest Quality

GEAR SETS

and

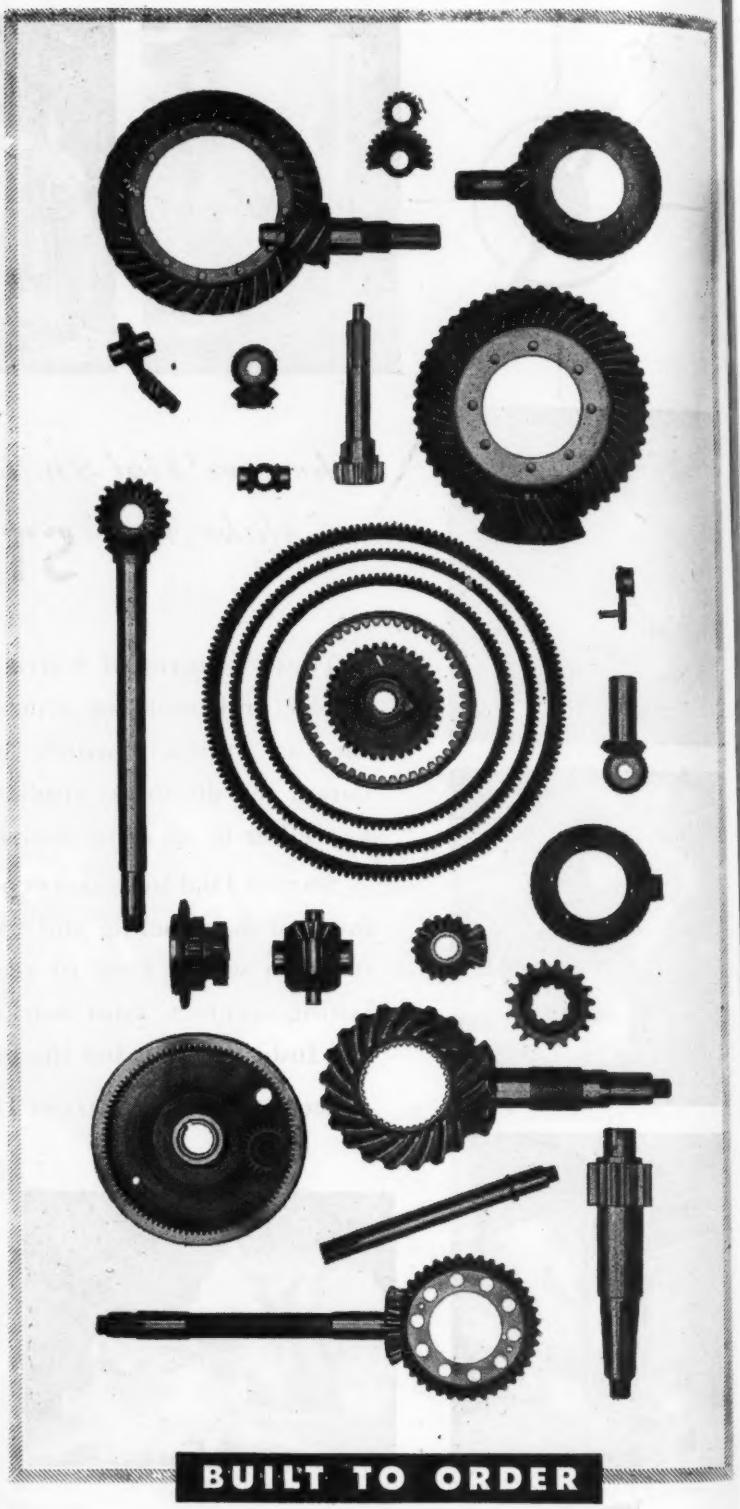
POWER TRANSMISSIONS

In Production Quantities

Automotive Gear Works specializes in BEVEL GEARS, *spiral, straight, hypoid and zerol tooth;* FLYWHEEL RING GEARS; SPUR GEARS, *straight and helical; and* GEAR SHAFTS.

● These gears are quiet, smooth-running, long-life, precision products—cut to your own specifications—or performance-engineered to your specific requirements.

Your inquiries will be given prompt and careful attention. An informative booklet will be mailed to those interested in further details on Automotive Gear Works' facilities and equipment.



BUILT TO ORDER

INDUSTRIAL • AUTOMOTIVE • FARM EQUIPMENT

Bevel Gears (SPIRAL, STRAIGHT, HYPOID, ZEROL) . . . **Spur Gears** (STRAIGHT AND HELICAL)

Flywheel Ring Gears . . . Gear Shafts

DOUBLE DIAMOND TRADE MARK GEARS

AUTOMOTIVE GEAR WORKS INC.

RICHMOND, INDIANA

Forgings Provide ADDED STRENGTH where it is needed most

The invisible added strength that is imparted by forging to both the machine as a whole and to the desired sections of forged parts, cannot be secured by any other process.

The high-speed, heavy duty machines of today require steel at its ultimate strength to assure safe, dependable, trouble-free operation. Maximum metal quality is attained in forgings; especially for these parts which are subjected to tensional, torsional and compression stresses. The superior fatigue resistance of forgings, retained to a high degree after repeated stresses, enhances the useful life of the machine in which they are employed.

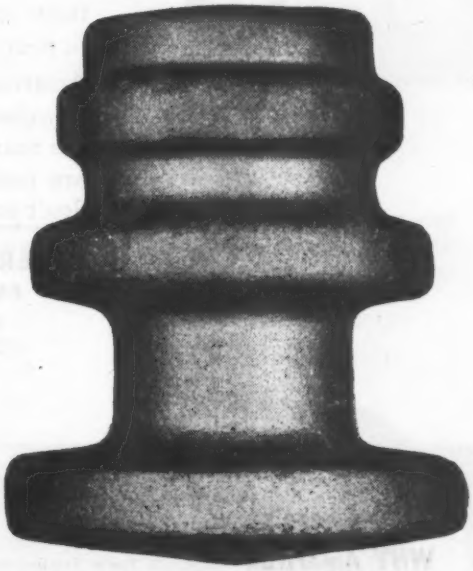
In many machine parts, some sections are subjected to greater shock and stress than others. Naturally then, it has become common practice for users of forgings to specify the directioning of the grain flow to meet the shock and stress recurring under actual service conditions. Proper designing of dies and modern day forging practice make it possible to develop the grain flow in the desired directions, as shown in the micro-views herewith. With controlled grain flow, the metal is compacted into a dense mass of high strength and toughness at the critical points. This characteristic, obtainable only in forgings, is of special value in parts subjected to fluctuating or reversing loads, impact or similar working stresses.

The engineering department of Kropp Forge Company will gladly consult with machine designers on stress problems.

Whenever you need flat die, drop or upset forgings, call your nearest Kropp engineering representative or send your prints direct for immediate quotation.

KROPP FORGE COMPANY
5301 W. Roosevelt Road Chicago (50), Illinois
Engineering Representatives in Principal Cities

The fiber flow lines indicate the added strength at points of greatest shock and stress obtained in the forging shown below.



SERVING INDUSTRY 18 SINCE 31 KROPP FORGE CO OVER 100 YEARS

KROPP

"FORGINGS TO EVERY SPECIFICATION"

William E. Kane

William E. Kane, president and founder of Kane & Roach, Inc., Syracuse, N. Y., manufacturer of cold-rolled forming machinery, straightening and bending rolls, and special machinery, died on October 11 at the age of seventy-nine years. Mr. Kane was born in Baldwinsville, N. Y., on January 27, 1866. His bent for mechanics was so pronounced that he left school at sixteen years of age to enter the employ of Heald & Morris, predecessors of the Morris Machine Works, in Baldwinsville, with whom he served a three-year apprenticeship. Then, for a brief period, he left the machine field to operate a book agency in Syracuse.

The present business had its inception in September, 1887, when Mr. Kane founded the Monarch & Eureka Co. which engaged in the manufacture of chemical boiler filters. Associated with Mr. Kane from the start of the business as a salesman in his employ was his brother-in-law, Bartholomew F. Roach. In 1891, Mr. Roach was admitted to partnership, and the firm of Kane & Roach was formed. In 1898, the company bought the site on which the present plant is located.

Through the span of more than half a century, Mr. Kane designed and manufactured a long line of machines, including pumps, hydraulic presses, wheel drills, multiple punches, spoke drivers, band saws, jointers, planers, and drill presses, in addition to the principal products of the concern—the cold-rolled forming machine, straightening machine, and the wrapping type bender, each of which was the first of its type on the American market.

William E. Kane

Arthur Charles Payne

Arthur Charles Payne, who for over twenty-six years was connected with MACHINERY as subscription representative, died on October 17. Mr. Payne was born in Silver Creek, N. Y., November 25, 1884. After having attended the Silver Creek High School and Bryant & Stratton's Business College at Buffalo, N. Y., he was employed as a bookkeeper by S. Howes Co., of Silver Creek, makers of grain-cleaning machinery. Later, he was associated with the Aluminum Castings Co., of Buffalo, as superintendent, being subsequently, transferred to that company's plant in Cleveland.

Mr. Payne became associated with MACHINERY as subscription representative in the upper New York territory in June, 1919, and at his death had been representing MACHINERY in the field for a longer period of time than any other member of the subscription staff. He was very highly thought of by all in the organization who came in contact with him for his outstanding integrity and ability in his chosen work. He made a host of friends in the territory that he covered. Mr. Payne is survived by his widow, Mae A. Payne, of Silver Creek, N. Y.

FRANK C. ANGLE, manager of the General Machinery Division field sales offices of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., died on October 25 after an illness of several months, at the age of forty-five years. Mr. Angle had been field sales manager since 1944. He joined the Allis-Chalmers organization in 1929 as a salesman in the Chicago office. In 1934 he was transferred to the company's San Francisco office, of which he became manager two years later. He was appointed Pacific regional manager in 1943.

HARRY W. COWAN, sales manager of the Machine Tool Division of the Chas. A. Strelinger Co., Detroit, Mich., for the last twenty-eight years, died on November 5 after a short illness.

DECEMBER 3-5—National Air Transport Engineering meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Edgewater Beach Hotel, Chicago, Ill. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

DECEMBER 5-7—Fiftieth annual meeting of the NATIONAL ASSOCIATION OF MANUFACTURERS at the Waldorf-Astoria Hotel, New York City. For further information, address the Association at 14 W. 49th St., New York 20, N. Y.

JANUARY 7-11—PLASTICS EXHIBIT and annual meeting of the SOCIETY OF PLASTIC ENGINEERS in Detroit, Mich. Exhibit will be held in Convention Hall and meeting in the Horace H. Rackham Educational Memorial, 100 Farnsworth Ave. Further information can be obtained from Fred Conley, chairman of the publicity committee, 510 Stephenson Bldg., Detroit 2, Mich.

JANUARY 7-11—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS and Engineering Display at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

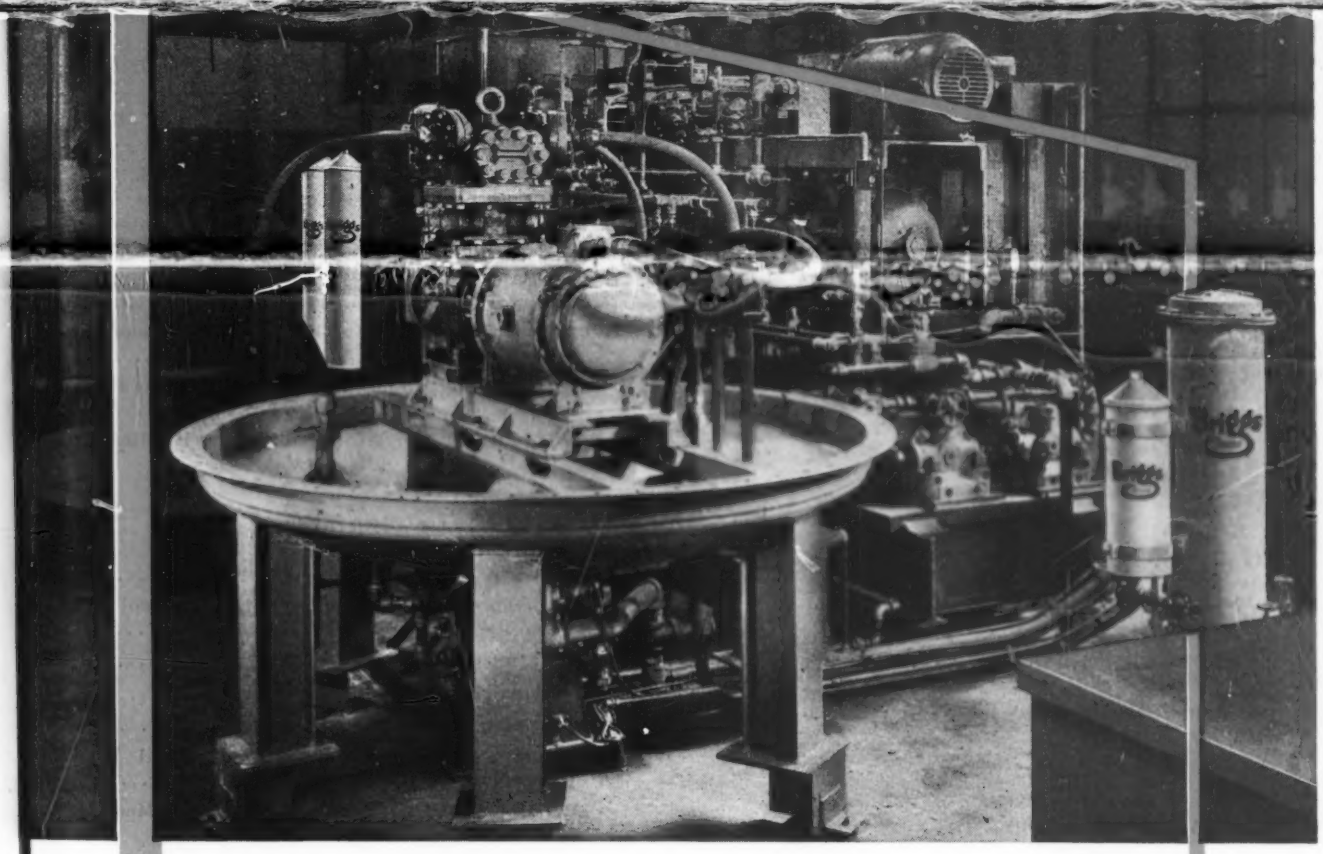
FEBRUARY 4-7—National meeting of the AMERICAN WELDING SOCIETY in Cleveland, Ohio; headquarters, Hotel Cleveland. Secretary, Miss M. M. Kelly, 33 W. 39th St., New York City.

FEBRUARY 4-8—METAL CONGRESS AND TWENTY-SEVENTH NATIONAL METAL EXPOSITION at the Public Auditorium, Cleveland, Ohio. Also annual convention of the AMERICAN SOCIETY FOR METALS in Cleveland; headquarters, Hotel Statler. National secretary, 7301 Euclid Ave., Cleveland 3, Ohio.

FEBRUARY 4-8—National meeting of the IRON and STEEL and INSTITUTE of METALS DIVISIONS of the AMERICAN INSTITUTE of MINING and METALLURGICAL ENGINEERS in Cleveland, Ohio; headquarters, Statler Hotel. Assistant secretary, Frank Sisco, 29 W. 39th St., New York 18, N. Y.

FEBRUARY 25—MARCH 2—Twentieth Exposition of Chemical Industries at Grand Central Palace, New York City. For further information, address Exposition of Chemical Industries, Grand Central Palace, New York 17, N. Y.

APRIL 3-5 — National Aeronautical meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel New Yorker, New York City. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.



"BRIGGS HYDRAULIC OIL CLARIFIERS *Prevent Trouble* FOR US..."

AYS THE CHIEF ENGINEER OF GEROTOR MAY CORPORATION, MANUFACTURERS OF THE FAMOUS GEROTOR PUMP

The Gerotor May Corporation installed Briggs Oil Clarifiers on this huge, yet delicate test stand for 3 REASONS—

1. They knew that maintaining hydraulic oil in perfect condition is the only practical way to prevent trouble . . . to reduce wear . . . to lengthen life of expensive equipment.
2. The performance demanded of this equipment made it imperative that protective measures be taken to safeguard its built-in ability to do a perfect job at all times.
3. Conviction, after thorough investigation, that the Briggs principles of oil filtration give greater protection and that Briggs Oil Clarifiers had proved their ability to remove all types of contaminants from oil. AFTER TWO YEARS OF OPERATION, BRIGGS PERFORMANCE JUSTIFIED THEIR CHOICE.

If you operate hydraulic equipment, you, too, must realize the importance of the first two reasons. And, you too, will come to the same conclusions Gerotor May engineers did, once you take only five minutes to become acquainted with Briggs Oil Clarifiers and learn WHY they offer you so much more protection against oil contamination and oxidation—the two enemies of hydraulically-operated equipment.

The Briggs distributor in your locality is at your service . . . ready to show you what Briggs Oil Clarifiers have done for others . . . HOW AND WHY AND WHAT they can do for you. Call him . . . prevent trouble before it begins.

ARMY (E) NAVY

Briggs

PIONEERS IN MODERN OIL FILTRATION

BRIGGS CLARIFIER COMPANY General Offices - Bethesda 14, Md.

ISTRIBUTORS IN PRINCIPAL CITIES • LISTED UNDER "FILTERS" IN MOST CLASSIFIED TELEPHONE DIRECTORIES.

Classified Contents of This Number

Brazing Practice

Copper Furnace Brazing—*By Glen A. Robinson*.. 139
Brazing Tool Tips to Shanks by Induction Heating —*By T. A. Vernor and E. F. Adams*..... 178

Diemaking, Die Design, and Press Work

Hydraulic Strippers Facilitate Drawing of Thin Shells—*By Henry F. Hild*..... 147
Aircraft Manufacturing Technique Applied to Bus Building—*By R. B. Stubbs*..... 168
Die for Forming Extruded Rivet in Sheet-Metal Plate—*By Wallace C. Mills*..... 191
Spring-Actuated Receding Guides for Locating Work in Coining Die—*By L. Kasper*..... 192

Gaging and Inspection

Method of Checking Compound Angles— *By James Ahearn*..... 182
Instrument for Checking Bore Diameters in Long Cylinders—*By Daniel E. McDonald*..... 192
Simple Gage for Checking Pump Gears— *By G. A. Almorth*..... 193

Management Problems

A Common-Sense Theory of Taxation..... 164
Putting Surplus Machine Tools to Work..... 176
Government Price Control Has No Place in Times of Peace 179
How Germany Built up Its Manufacturing Industries..... 180
The Sole Purpose of Industry is to Serve the Consumer..... 181
Initiative and Enterprise are the Cornerstones of Industry..... 188
Industry Must Use Today's Knowledge..... 188
Production is the Main Foundation of Maximum Employment..... 189
When is a Purchasing Agent Personally Liable for Contracts He Has Signed?—*By Leo T. Parker*.. 195

Materials, Metals, and Alloys

Carbide Used for Tool Grinder Ways..... 160
Vinylite Plastics—New Applications of a Product of the Bakelite Corporation..... 185
The Problem of Cutting Fluids..... 194
Machine-Tool Cast Iron..... 195
Meehanite for Screw Machine Cams..... 195
New Free-Cutting Copper Rod Saves Machining Time..... 196
Non-Flammable Thermosetting Plastic Developed by Goodrich..... 196
Improved Grease for Ball and Roller Bearing Motors..... 196
Flux for Aluminum Soldering, Brazing, or Gas Welding..... 196
Synthetic Plastic Adhesive for Laminated Construction..... 197
Special Low-Carbon Ferro-Manganese Announced by Electromet..... 197
New Ceramic Material Has Unusual Dimensional Stability..... 197
Rust Inhibitors Developed for Inside Storage Protection..... 197
Hard-Facing Alloys for Electric Arc Application.. 197

Meetings and Exhibits

Tool Engineers Plan Exposition..... 140
New Officers of the National Machine Tool Builders' Association 154
Material Handling Society Formed..... 160
National Patent Council..... 167
Meeting of Committee on Cutting Fluids..... 194
Annual Meeting of the National Metal Trades Association..... 198
Machine Tool Distributors Hold Annual Meeting.. 198

News of Industry

Pope Machinery Corporation Celebrates Twenty-Fifth Anniversary 177
Engineering News..... 186
News of the Industry..... 239

Shop Practice

Belt Grinding—One of the Later Developments in the Grinding Field—*By W. A. Papworth*..... 155
Recent Applications of the Thread-Rolling Process 161
Surface Finish of Crankshaft Bearings Improved at Cadillac..... 164
Use of Solvents in Cleaning Machinery for Reconversion—*By Mable Foy*..... 165
Simplified Practice for Machine, Carriage, and Lag Bolts..... 177
Demonstration of Kennamilling 179
Shop Equipment News..... 199

Training, Apprentice

Increase in Apprentice Training..... 181
Apprentice Training for Returning Servicemen.. 185

Your Progress Depends Upon Your Knowledge of Your Industry